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[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF EDITOR, WRINKLE DEPARTMENT,
MILWAUKEE, WIS., Oct. 25, 1905.

To the Members of the Western Gas Association: The next meeting of the Western Gas Association will in all probability be the last one, owing to the proposed merging of the three leading gas associations. Therefore, every effort should be made to make it a rousing success in all respects, and it falls to my lot as Editor of the Wrinkle Department to again appeal to you for this department. I earnestly request those who have made promises of contributions to remember such as soon as possible, and I fully expect to hear from quite a number who have not made any promises, but who I know are in possession of something that would prove of value to the Wrinkle Department.

Yours very truly, B. MCADAM, Editor.

[NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE WRINKLE DEPT.,
719 CITIZENS BUILDING,
CLEVELAND, O., June 13, 1905.

The Wrinkle Department of the Ohio Gas Light Association is now ready to receive contributions for the 1906 collection, and a sketch or description of all devices, formulæ and methods of accomplishing objects pertaining to the gas business, is respectfully solicited.

Please send a written explanation, accompanied by any sketch, photograph or drawing, to the above address, or a description alone will suffice.

Hoping to receive prompt compliance,

Yours very truly. W. E. STEINWEDELL, Editor.

BRIEFLY TOLD.

THE NATIONAL COMMERCIAL GAS ASSOCIATION CONVENTION, NEW YORK MEETING.—The Directors of the National Commercial Gas Association ask us to give out the following which will be of interest to many in the gas fraternity and the field of appliance manufacturers who are desirous of being informed regarding the plan for the forthcoming convention of that Association to be held as stated. The Directors' notice is as follows: At a Directors' meeting of the National Gas Association, held in New York on the evening of December 11, in pursuance of a call previously arranged for by the President, Mr. William J. Clark, who had, for the consideration of the Directors, prepared various matters regarding the forthcoming meeting of the Association, it was unanimously decided that the dates of January 24th and 25th should be the convention days in place of the date which was selected at the June meeting namely, January 10. This change of date was deemed advisable in view of the fact that most gas companies, as well as manufacturers,

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are busily engaged in closing the previous year's affairs early in the month of January. Addresses and papers of special interest are being planned for through a Committee of Arrangements, of which Mr. Fred. K. Wells is Chairman, which Committee also has in charge the preparations necessary to the comfort and pleasure of those attending the meeting. Headquarters for the convention will be the Hotel Cadillac, 43d street and Broadway, New York City, and the sessions are to be held in the new and beautifully appointed dining hall of the hotel, entrance on 43d street. The proprietors of the Cadillac will room those attending the meetings at the rate of $2 and $2.50 a day (European plan) in rooms with private bath. Instead of a formal banquet, it is planned to have luncheon served between the morning and afternoon sessions each day, thereby bringing those in attendance into close personal touch in a most informal manner. The plan seemed to the Directors as possibly the most successful means of promoting personal acquaintance which is so important to the success of an enterprise of this nature. It is proposed that those present shall have the opportunity of attending the Hippodrome in a body on Wednesday evening, January 24th. The performance at that noted place of amusement during the fourth week of January will be most elaborate. It is the desire of the Committee of Arrangements to secure sittings occupying a section. This can only be done, however, several weeks in advance of the performance. In order that these accommodations may be reserved in advance, those intending to be present should promptly notify the Secretary at 265 Broadway, New York City. In passing the various resolutions placed before the Directors at their recent meeting, there was absolute unanimity of thought and purpose to make this Association a marked success and of the greatest possible assistance to the gas interests of the United States. Your help in communicating to others the information contained in this notice will be deemed by the Directors a personal help towards securing a large and enthusiastic meeting. The entire cost per individual for the two luncheons between the morning and afternoon sessions of the first and second days and the attendance at the Hippodrome, will be $4 complete. This amount should be sent by check or money order when replying to this announcement. As stated, the need for hearing from those who propose to assist without delay is on account of the absolute necessity of securing seats at the Hippodrome several weeks in advance of the performance. To those attending the convention who may be accompanied by ladies, the hotel proprietors make the announcement that an added charge of $1 a day will be made for each extra person, and a rate of $1.50 will be charged for each additional Hippodrome ticket for either lady or gentleman. The ladies will be welcome in the Hippodrome party. A committee of ladies will be in attendance to escort visiting ladies wishing to attend the Hippodrome, and a ladies' luncheon, for which there will be no extra charge, will be arranged either on Wednesday or Thursday. The Directors seriously considered the matter of a gas appliance exhibition in connection with this first meeting, to be followed by appliance exhibitions each year at the succeeding conventions. In view, however, of the fact that there are no doubt many who intend joining the Association between this time and the date of the first meeting, and that such will wish to have a voice in the matter respecting the method of exhibition conduct, etc., it seems best to defer the exhibition plan until the next meeting of the Association.

NOTES—

MR. JAMES DILLON, of the manufacturing staff of the Leadville (Col.) Gas Company, died at his home in that city the morning of the 13th inst. He was in his 38th year.

THE Cincinnati (O.) Gas and Electric Company has called a special meeting of its shareholders for Wednesday next, the purpose of the meeting being to consider a proposition to authorize the Company to so amend its articles of incorporation as to permit it to engage in the sale of natural gas. The meeting is certain to result in the sanctioning of the project.

THE order of the Massachusetts Board of Gas and Electric Light Commissioners, putting the selling rate by the Charlestown Gas Company at 90 cents per 1,000 cubic feet, becomes effective the 1st prox.

THE last entertainment given by the Gas Companies' Employees' Mutual Aid Association, of this city, was the most effective and enjoyable one that the Association ever gave. It was brought off in the Lexington Avenue Opera House the night of the 15th inst. The Society has 2,000 members, and its officers are: President, Dr. A. H. Elliott; Vice-President, Arthur Postley; Secretary, Wallace Young; Treasurer, William H. Ferris.

[ABSTRACT—Continued from Page 1013.]

PROCEEDINGS, THIRTY-THIRD ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

HELD IN THE HOTEL PFISTER, MILWAUKEE, WIS., OCTOBER 18–20, 1905.

SECOND DAY—AFTERNOON SESSION.

The President called the meeting to order at 2:30 o'clock, and introduced Mr. H. L. Rice, of Aurora, Ills., who read his paper on

HIGH PRESSURE GAS DISTRIBUTION OF TO-DAY.

[For the text of Mr. Rice's paper, see JOURNAL, Nov. 13th, 1905, p. 794.]

Discussion.

The President, in inviting discussion on the paper, expressed the hope that it would be general, as the subject was very interesting.

Mr. J. D. Shattuck said—Referring to the matter of steam consumption at the different pressures, on the test made by us at Chester several years ago we found that a single, simple straight line compressor required 80 pounds of steam per horse power, while a duplex compressor required only 20 pounds. The cost of operation was about 1¾ cents, but that did not include the oil to raise the candle power $\frac{3}{16}$ that was lost in the pressure. This figure, of course, might vary. He found one case running nearly as high as 5 cents per 1,000 feet of compression, due to the fact that extra engines were required to govern the tension out through the district, and that the drip water had to be brought in. Where it did not require any extra labor Mr. Shattuck said that 1¾ cents was a fair price. The duplex compressor would compress 1,000 cubic feet on 1¼-horse power. Mr. Rice, the speaker noted, had said that the moisture question had been satisfactorily settled, but many would disagree with him. Continuing, Mr. Shattuck said: I should like to ask Mr. Goodnow how he arrives at the size of the "bleeder" to take out the moisture—that is, the velocity at which the gas is passing through the bleeder? For instance, we have put in the "bleeder" system, and while pumping the minimum amount of gas it satisfactorily takes out the moisture, but as the velocity is increased it does not do so, and we do not think it is entirely due to the size of the "bleeder." We think the moisture is carried in suspension and that it is carried through. Just before leaving home to attend this meeting I got some comparative costs on pipe to determine the size with which we could use Dresser couplings. The standard 4-inch pipe weighs 10.66 pounds and costs 26.65 cents. The lightest 4-inch pipe made for this purpose is 10 pounds and costs 25 cents. There is a 4 per cent. saving in sockets and 4 to 5 per cent. saving in thread, making a total saving per length of .65. While the 4-inch coupling costs 1.35, the 6-inch full weight pipe costs 48.8, while the 15-pound pipe with which we use the Dresser couplings costs 36.3, making a total saving per length of 9.81, while the coupling costs 2.25. It has been shown that extension joints are not needed in the line, except where valves are used; that is, valves over cast iron fittings. Cast iron fittings should not be used at all, and if they are the joints should be placed on each side of them. I recently saw a line laid entirely with cast iron fittings and from our own experience I know they will have sooner or later to take them out. I do not think a solving of the electrolysis problem has anywhere near been reached. The North Adams (Mass.) line has insulated joints every 500 feet, but they are still suffering from electrolysis there. The electrical expert who made a survey told us if we put insulated joints on every length of pipe we would cut down electrolysis only 5 per cent. No satisfactory cutting down of electrolysis has been obtained as yet. Two years ago they began using cement coating on the pipes, and thought they had saved themselves from the trouble of electrolysis. It saved the life of the pipe considerably, but wherever moisture gathered between the cement and the pipe it did its work quicker in that place, or if the cement was cracked off the destruction was more rapid. A 6 months' test of candle power compression practically confirmed the figures given to the Ohio Association last spring of .9 candle—this is compression in delivery. I have been asked by several people if the dry gas of compression reaches the diaphragm. None of our meters taken out on high pressure lines and tested show that yet, and we do not find the meters running slower than the ordinary low pressure meters; but that was a subject that might be investigated. He thought that all high pressure lines should be dripped, and that the drips need not necessarily be taken at the low point, but beyond the low point, in the direction in which the gas was being pumped, perhaps at an elevation of 2 or 3 feet beyond the low point. Their diaphragm plates might catch all the water, but if they do not you want to know where they were going to get it. They found 2 years ago in cutting

their line about 4 miles from the works, that it was coated with a sort of liquid gummy substance from ⅛ to ¼-inch thick. About a year ago they started compressing coke oven gas, and at the end of 6 months they began to compress water gas. At the time they stopped compressing the water gas they cut the line and found that the gummy stuff had disappeared, and that the line was filled with a black powder. That powder in conjunction with naphthaline was stopped by corporation cocks, where there was considerable drop in pressure between the main line and the lateral line. Their chemist told them that a simple hydrocarbon deposit was the root of the trouble. It formed with the naphthaline practically a solid ball on the end of the opening on the lower pressure side of the opening. It showed up sometimes for a considerable distance. They overcame that by simply increasing the size of the pipe used to take off the lateral line. It meant that you could not have too great a drop in pressure between the main line and the lateral line without naphthaline troubles, mixed up with that deposit of some metallic appearing hydrocarbon. He wanted to emphasize this point not brought out in the paper. The high pressure system will require a great deal more attention and more inspection than is given their low pressure system. They made it a point to go over their governors once in 6 months, and they kept a record of the pressures found on the governors, the conditions of the seals, etc. A consumer, when he had a slight variation in pressure perhaps would not complain at the office, but he was getting unsatisfactory service. They found that if the seat of the governor valve began to deteriorate, the pressure with all the lights in fell off before the closing-in pressure arose, so that it might give a range in pressure from .8 to .30, and the governor might be called satisfactory, but beyond that the valve should be changed.

Mr. G. F. Goodnow said that as to the separator Mr. Shattuck spoke of, while they had not determined exactly what they would do finally, they had put in another one beyond that point. If their line was carrying more pipe they added another separator, until now the line he was speaking of had a pulsation tank with adjacent diaphragms immediately after the compressors, then two more about 500 feet from the compressors, and another one about 1,000 feet beyond. Last year they had no trouble with the previous one and put in the second one with baffle plates. They did have trouble with freezing.

Mr. Shattuck asked if there had been any unusual trouble from electrolysis.

Mr. Goodnow replied that the trolley people had also relaid their tracks, and double tracked, which had materially cut down the amount of return current going into the ground. Continuing, Mr. Goodnow said: Respecting data regarding sales of gas in thinly populated suburban territory which would be entirely out of reach with low pressure distribution. These figures cover a period of 2 months (August and September) and were by districts with approximate population shown by the census with an estimated increase of 20 per cent. up to the present time:

Population.	Sales for 2 Months.	Average per Meter, Read per Month.	Miles of Main.
3,125	4,177,300	4,530	16
4,157	4,700,100	3,574	21
1,200	723,500	2,415	7

The first two districts have been in the course of development a little over four years, while in the last district the first meter was set May 20th. The actual amount of gas, which has been sold through a 4-inch line, 13 miles long, with smaller branches extending 3 miles further and numerous other branches taken off all along the line, shows the actual working results of this method. The initial pressure was about 30 pounds. During August there were sold 5,244,000 feet, and during September 5,385,000 feet. Figured on a basis of any formula given by Mr. Rice, the peak load of this line could not be carried. It is estimated that from 20,000 to 25,000 cubic feet per hour were delivered at certain periods of each day, and this brings us to a consideration of the value of compression tanks near the point of consumption at the peak of the load. Four such tanks are now in use at 2 points, 2 tanks about 6 miles and 2 tanks about 13 miles from the compressors. Each tank at 30 pounds will deliver about 3,000 cubic feet of gas, making a very material aid in maintaining pressure at distant points during the hours of greatest consumption. Their value was also demonstrated several times during the last few months, particularly one Sunday afternoon when the line between the compressors and the first pair of tanks had to be cut and some changes made. Difficulties were encountered which rendered it impossible to turn the gas on for 5 hours, yet the district supplied was not out of gas at the time, although the pressure dropped to about 4 pounds, which was sufficient excuse for the existence of these tanks, for such emergencies were likely to arise at any time. These tanks are tested to at least 75 pounds, so that if advisable the pressure could be increased, which would, of course, also increase the capacity at the rate of 1,500 cubic feet for each atmosphere of increase. The cost of these tanks was about $130 per 1,000 cubic feet of gas, and contained at 30 pounds a storage cost which was less than small holders per 1,000 cubic feet contained. The method of collecting condensation within 1,000 feet of the compressors by means of separators with baffle plates which were intended to momentarily decrease the speed of the gas and drop the moisture had been quite successful. It was advisable, however, to furnish a drip cock or blow off at low points, so that in case liquid was found in such places it could be easily disposed of. The writer had occasion this year to move about 2 miles of 4-inch line pipe which had been in the ground nearly 5 years. This pipe was in a hard, yellow clay subsoil. It had been painted one coat with a heavy tar or asphalt paint, and the pipe was about 10 per cent. heavier than the standard line pipe. It was found in excellent condition and would be used again. Certain small areas have, however, been found where the ground contained cinders that was badly affected. Cinders in connection with electric current from a trolley line make a bad combination and lead them to protect the pipe from the cinders at all hazards, either by clean earth or a cover of tar concrete placed about the pipe and boxed if necessary. This success in reducing the electric current flowing on this pipe by using insulated joints at regular intervals lead them to think that this trouble could be almost entirely eliminated by proper attention to placing such joints in danger areas when pipe was laid. It could also be accomplished after the pipe was in use, but that was of course more expensive and difficult at such time. He had only elaborated from his experience a few points touched upon by Mr. Rice, as that gentleman had completely covered the ground and brought the subject up to date in a form which they would all be glad to refer to when this subject came up in their everyday operations.

Mr. F. S. Richardson, North Adams, Mass., said there were two or three essential points that should be emphasized in a system, one to get pulsation tanks at the station, bleeders on the line of sufficient capacity, and compression tanks at the extreme point. They were all essential as well as the regular and intelligent inspection of all the governors. As to the last statement made by Mr. Goodnow concerning the insulating joints, he would say that in their case he should take exception to it. The specification furnished by Mr. Shattuck provided for one insulating joint every 500 feet, which was on account of the very great trouble they had in North Adams. They might put in an insulating joint every 500 feet, or every 20 feet, but if they ran parallel to any single trolley they would have trouble unless the pipe was run in perfectly dry soil. They had in process of elimination 95 of these joints on 6 miles of pipe at considerable capacity. They have a special bond made with carrying capacity of No. 0000 wire and special clamps, which joints were to be eliminated, making the pipe a straight carrying line for the return current. Opposite the power house, which in the 6 miles of 4-inch pipe is in the center of that distance, there were to be 5 taps made from the pipe, carrying the current back to the rail and directly to their switchboard. Opposite that power station they had just removed 600 feet of the 4-inch pipe, 3 lengths of which were entirely destroyed. One length had 27 pits, and 3 separate pipes were pitted so badly that the gas leaked. The pipe was not disintegrated; it was destroyed. Possibly the conditions which existed there were ideal for that trouble, but in any event any wrought iron line running parallel to a single trolley track will certainly be destroyed in a comparatively short length of time. Judging from their experience, covering 2 years, the safest way is to make a line running perfectly clear of all insulating joints, tapping to the rail wherever it is possible; also to the water pipe and carrying a line of ample capacity, or with a number of copper wires, the lost current from the pipe to the switchboard. There was no danger if properly done, and if they agreed with the trolley people, who absolutely refuse to acknowledge any responsibility, some trouble and no little danger would be eliminated. He firmly believed that the trouble would have to be acknowledged by the trolley people as a nuisance, and by common law no one would be publicly permitted to maintain a nuisance. He thought that in time the railroad companies would have to pay for damages done, but the trouble was in the present. The high pressure system for gas distribution, in the speaker's mind, was a success. If properly installed it was simple, efficient, reliable and economical. Aside from that, in his opinion it was a very great blessing to the smaller towns, for the figures here shown proved it. He would say to those present that if smaller towns were within their reach, they should not delay in attaching them to their central stations. The work should be done well, and in 2 years' time they would be glad that the work had been done,

perhaps sorry it had not been done earlier. Regarding the North Adams installation, which was only a matter of 13 miles and which was one of the first of that length in New England, he would say unhesitatingly there were no troubles if the line were properly watched that could not be overcome. They had no holder at Adams or Williamstown, but they had a double set of compressors, each with a capacity of 20,000 cubic feet per hour, which were led alternately. Being in the exciter room, the same man who attended to the exciter ran the compressors. The steam required for the operation of the compressors was tapped from their electric light station feed, but the amount required was not noticeable. There were many economies in every direction in the maintenance and operation of the high pressure system at its present state of perfection. He agreed with Mr. Shattuck that the drips should not be placed always at the low points, but the pipes could be drained and the drips could be blown by allowing the pressure to fall to say 2 pounds at an hour in the day when the draught would allow it, but if the drip should be placed at an elevation of from 8 to 12 inches beyond, one would get such little condensation as would come at those points without passing the compression tank to the "bleeders." The line to Williamstown passed 3 bridges, over which they had increased the 3-inch pipe to 6-inch pipe, thereby enlarging the capacity. They had a drip at the feed end of each bridge, and last year there was not a single instance of stopped service from frost; in fact, they had absolutely dry gas. From his experience, he unhesitatingly said there was no need to use any holder for the lower pressure distribution in the place. If the works in a small place were shut down, one must necessarily have heat to keep the water from freezing, but the holders are absolutely unnecessary for the successful distribution of gas through a proper district governor ran in duplicate.

Mr. Walton Forstall's contribution to the discussion was: I wish to emphasize the point by Mr. Shattuck about the use of plain end instead of screw end iron pipe, in sizes of 6 inches and over; certainly 8 inches and over. I believe in using the plain end pipe, because besides saving money in the first cost you are able to provide yourselves with what I consider the very best remedy against electrolysis. And there I disagree with Mr. Richardson. It seems to me, if I were confronted with the proposition of laying a high pressure line in any region where I thought there was danger of electrolysis, I would try to get some idea of the amount of current that was leaking into the ground. Then I would try, by making some prior tests, taking a plain end line, with rubber insulating couplings at every joint, to see whether if that line were laid there would be as much conductivity on the line and whether there was as much electricity coming on the line. If that test indicated my line would still take electricity from the trolley company, it seems to me I would try to go after that trolley company in some way, and would not expect, as a last resort, do what Mr. Richardson is apparently doing at North Adams. I should imagine that his line carrying the electricity, which it probably is, might induce him to take some special precautions when tapping. Bearing on the question of just where the high pressure distribution ought to stop and the low pressure distribution begin, I made a few figures. Taking the average size of the high pressure line as 1.5 inches, and the cost per foot laid as 17 cents; that gives $900 per mile. I see that the average size of high pressure main is figured on a basis of 20 to 30 pounds compression. Taking the average size of the low pressure main as 4 inches and the cost per foot laid as 40 cents, figuring in both cases on suburban conditions, it would give a cost of $2,112 per mile. I assume the cost of compression, including interest and depreciation on the investment, as well as the maintenance of the compressors, at 2.5 cents per 1,000. In the cases of the high pressure line, figuring on a mile of main, taking depreciation in every case at 5 per cent., on the high pressure line we have $90 per year per mile. For the low pressure, figuring interest at 5 per cent., and depreciation at 2 per cent., we have $148 per year per mile of main. For compression I allow 2.5 cents per 1,000 cubic feet, and apparently 2.5 cents is not very high. From Mr. Shattuck's figures, then, when we have a consumption of 1 million per mile we have to add to the high pressure figures for comparison with low pressure figures, $25; for 2 million per mile we have to add $50, and the $50, plus $90, gives $140 for high pressure as compared with $148 for low pressure, so that when you are selling 2 millions per mile high pressure will be more expensive than the low pressure. That checks up pretty well with an investigation made from another standpoint, which shows that when you reach 110 services per mile, you reach the dividing line between the high pressure and the low pressure. I think it is of interest to bring these figures up, because apparently in the minds of some people, according to the questions asked in the Ohio Association Question Box last year, some of those who asked the questions thought it was time to consider high pressure work in large cities, and it occurs to me it is well to have some idea as to where the limit may be found between high pressure and low pressure work.

Mr. F. S. Richardson said they had taken 8 months to make a careful test all along their line, and it was a positive fact that no single trolley road could be operated without a loss of some current. It made no difference how perfectly every joint was bonded, or what the carrying capacity of the joints might be, it was an inherent necessity in the very kind of system they maintained that a single trolley would make a loss of current, especially in certain soils. It was a fact that you could get a difference of potential between the opposite points at each insulating joint, and it was a fact whether you have one of these insulating joints in 1,000 feet or one in each 20 feet, if that wrought iron pipe runs parallel to a single trolley one could always get some show of current. Of course, one cannot always get like amount of potential at the same joint, but some is there always. Along the line there may be a neutral point, where one may not get any evidence of potential, but the next day or next week, one would get double the amount 1,000 feet north, east, south or west therefrom. They were forced to the conclusion, under the circumstances which surrounded the installation, that the only safe way to eliminate the destruction of cast iron main, running 5 miles parallel to the single trolley, was to do just as they are doing. They did not want to do it, but were forced to it. He did not think as a matter of fact there was any danger, in view of the fact that the return itself would follow the line of least resistance, but with these insulating joints maintained, and the connection made opposite the power house to return to the switchboard, the destruction at the insulating joint would be increased from 2 to 10-fold, and as had been told too, in their case each one of the pipes where the current left the pipe was damaged, even with the insulation. The entire pipe lines in circumference were found to be pitted more or less, so that it was not only upon the assumption of a theory that they adopted this method. It was after 8 months of careful investigation and testing that their decision was made. That was the only practical deduction they could make under the circumstances, as these were found. As a general proposition he thought it would be found that any pipe line running parallel to a single trolley would always be found to have some waste current.

Mr. W. Forstall wanted to know whether Mr. Richardson measured the resistance on the line of pipe with the insulating joint at the end of every length, and whether he found the conductivity was greater than the conductivity of the trolley?

Mr. Richardson—Between the pipe and the rail?

Mr. Forstall—You did not have your line equipped at every joint?

Mr. Richardson—Every 500 feet.

Mr. Forstall said his point was, if the wrought iron pipe line had been laid with an insulating joint every 18 feet the conductivity of the line would be so low that the amount of electricity which would escape from the track and go on the line and stay there, would it not all jump around every insulating joint and would not one get electrolysis on every joint? He figured the amount of electricity which would be on the line under these conditions would be so small that the resulting damage would not be material, and he preferred that condition to the other or existing one. Probably what they were doing in North Adams might be the best thing for that particular case, but it seemed to the speaker that if a man had a free field, what he wanted to do was to make his line of the least possible conductivity.

Mr. Richardson granted that the speaker was in a measure correct, but assuming that the insulating joint was to be put in the line at every length, from his standpoint it would be very bad construction, in that it would unnecessarily multiply the points of trouble, danger and expense. If they put 1, 2 or 12 such joints in very moist earth or earth of a peculiar character, they would get at that one joint all the current which would find a path from the rail to that part of the pipe, and in jumping from one side to the other a pitting would occur in that one joint. If one went through sand, or could entirely avoid all moist earth, where they did not have to go under water, an insulating joint at every length would reduce the trouble to a minimum, but it did not seem to him a good construction.

Mr. Forstall did not suppose they could argue the thing now and settle it as a general proposition, because it depended on the relative conductivity of the path afforded to the current for the return to the power house. What Mr. Richardson probably had to contend with was a poorly built trolley line. The whole question was whether, in Mr. Richardson's case this poor return path along the iron rails of a trolley with poor metallic contact was better or worse than a plain iron pipe with an insulating rubber stop-cap every 15 or 18 feet in the wrought

iron pipe. What Mr. Richardson said about the conditions of the soil was true. They might have very bad electrolysis where the pipe went through wet soil. If the pipe went through such soil they might find electrolysis very much worse than at the point where the pipe went through dry soil, but the chances were the two things were pretty close together; where the pipe was surrounded by wet earth, the rail would be surrounded by wet earth and there would be less chance for the current to jump.

Mr. Richardson thought they agreed on the basic point, that the individual case must be settled by what was found were the local conditions. He was free to confess that physically the territory through which they ran for the harm they were receiving the character of the soil conduced greatly to trouble from electrolysis, but on the other hand the system was operated by people who were not perhaps as careful as they should be. At any rate, they had been working 7 months constantly rebonding the entire line, and ever since then they had been done this damage. Save for that they would not have paid any attention to the condition of their tracks.

Mr. A. E. Forstall said that for Mr. Richardson's benefit he proposed to give a little experience which happened to him with a pipe that was made with as perfect a conductor as possible and bonded to power station. It was not a continuous pipe and, therefore, was not as good a conductor as it might have been. It was a cast iron pipe with leaded joints, but it carried enough current, whenever there was a car passing anywhere near where their service gang was working, to send a spark 3 or 4 inches long between the ends of the service pipe. They thought that was a very poor plant.

Mr. Richardson asked what condition the trolley was in as to its bonding?

Mr. Forstall said it was in ordinary, average condition.

Mr. Richardson thought that was very bad.

Mr. Forstall didn't think it was very bad. He thought it was probably better than the average country road.

Mr. Richardson said he did not mean to say the average condition of the single trolley road was very bad, as to the bonding, etc.

Mr. Forstall remarked it was a 9-inch girder rail, with 2 quite heavy copper bonds at each joint.

Mr. Richardson said the weak point in the trolley system was that a bond broken, a switch misplaced or ruptured, and not put back in proper condition, would cause great damage, and perhaps unwittingly, but the fact remained that it was the case and they had to suffer.

Mr. T. Bunker thought it was fair to state on the Richardson side of the argument that the 12-inch pipe line from Camden to Trenton, N. J., was parallelled by a single trolley track, and he was told by electrical men that it is one of the poorest bonded roads in the country. They at Camden were facing conditions very much like those stated by Mr. Richardson. They had evidence of electric current on the 12-inch pipe line. The men working there on the line would see the sparks fly from it very much as Mr. Forstall described. They had a survey made under the direction of Mr. Lupke who showed that the difference in potential at various points ran over 25 volts. Their recording instrument only registered 25 volts, and the needle banked against the top of the scale. There were two power houses on that line, and the line passed through a number of creeks, completely under some of them, but as a rule the soil through which it passed was dry, even sandy. Mr. Lupke told them the only thing to do was to bond to the power house and they had actually put in a very heavy copper wire running from the pipe to the power house. The line had been in operation on that system for 3 years, and the speaker had dug up the 12-inch line at several points and had not been able to discover any evidence of electrolysis. Under the conditions faced between Camden and Trenton the best thing was to bond back into the power house. They originally had the line laid out on a method of putting in insulating joints, but the plan was not feasible and they did not have any success until they bonded back to the power house. He questioned very much whether the original cost of insulating joints would not have offset the advantage. He thought if the pipe line had been cut up into small sections, that the current would leap from the trolley line back to their pipe, and so be forced to leave the pipe at some point and then they would get electrolysis.

Mr. Richardson said that out of justice to himself the opinions expressed by him were the concurrent opinions of two very excellent electrical engineers to whom they took the problem, telling them their plan of procedure before the decision was made. Therefore, it was not only deduced from the actual experience of themselves, covering a period of 15 months, reinforced with the experiments they made, tabulated and presented to them, but it was their deduction from their own scientific point of view. Consequently, taking the experience and commonsense end of it, strengthened by expert opinion, they were led to make this change in the line to safety.

Mr. E. E. Brownell, of Chicago, said he realized the fact that he knew little or nothing about gas, but he asked their permission to straighten them out on the matter of electrolysis. He was sorry to have to call the attention of the speakers who had preceded him on the floor to the fact that electrolysis was not dependent on the conductivity of the line. He supposed that 99 out of 100 went back to the old rule that a current of electricity took the path of least resistance, which was a misnomer; a current of electricity took all paths available to it, inversely proportional to their resistance and directly proportional to their conductivity. He had the nightmare repeatedly over insulated joints, and this was his first chance to say to the Association that such joints were not worth a cent, and for two reasons, one of which was that they had debarred two classes of mitigation. If one owned an electric street railroad, and another owned a gas works, both wishing to work in harmony, they could not do so by using insulated joints. They debar all classes of mitigation known to be effective. He repeated once more that the conductivity of the pipe alone did not govern its rate of depreciation electrolytically, and when one once got away from that one would see the subject in a proper light. He thought he could say, and that the Association would bear him out in the statement, for he had inspected plants covering one-half of the gas distributing systems of the United States, that there was no other subject that was treated with such ignorance as electrolysis. Were he a gas man and had gas-tritis he would not go to a gas man to get cured. He wished to go on record as saying that the installation of insulated pipe joints was worthless, and if that were not plain enough, he would quote a paragraph of his in a report made by him to the Bureau of Lighting, Pittsburgh, Pa.:

"Any manufacturer, contractor, or consulting engineer, who sells, installs, or recommends an insulated pipe joint with the claim that it will eliminate electrolytical corrosion on pipe lines does so either with the sole purpose of defrauding the purchaser, or through sheer ignorance, which is still worse."

Mr. Stilson asked Mr. Brownell how he arrived at his figures? Were they theoretical or practical?

Mr. Brownell said he had not obtained a figure theoretically. The proper way to arrive at the matter was this: In a certain locality is a power house, which power house has certain zones surrounding it known as danger zones. He took a contour line, where the difference of potential was least between the pipe and rails, and the pipe and earth, and where the current flow on the pipe was the greatest. He then took the amount of current entering that point, and all the current that went back by the pipe lines across that contour line, which of course was the amount of current the pipe lines actually carried. In Pittsburgh the amount the pipe lines actually carry, compared to the amount passing to, from and over them, was only 7 per cent. Say that the amount is 200 amperes, and the amount passing to, from and over the pipe line, according to Ohm's law, was several thousand amperes. They took the amount of current crossing any contour line, and compared that with the amount of current passing over the pipe to the rails according to Ohm's law.

The President asked Prof. C. F. Burgess, of the University of Wisconsin, to say a few words on the subject.

Prof. C. F. Burgess in reply said he wished to take some exception to the claim which had been made for his expert ability along this particular line. He had made some tests but did not wish to prolong this discussion, further than to say that one can apply Ohm's law to this matter, as the previous speaker said, but in applying that law they did not really get any theoretical deduction, because Ohm's law cannot be denied. They knew that current would leave the rail and part of it would travel through the earth back to the station, whether they bonded the pipe or not. Some of that current was going to travel through the earth. If they had pipes along the path which that current travels, and as metals were a million times better conductors than the earth, consequently, whether they had 18-foot lengths of pipe or 500-foot lengths of pipe, or 1 mile lengths of pipe, the pipe would offer a better path for the current than the earth, and the pipe would carry perhaps a larger portion of that current. If they used insulating joints and did away with the metallic means for the current to get back to the rails, they were bound to have electrolysis, which was a fact proven by laboratory studies as well as practical experience. Where the current left the pipe it took a certain part of the metal with it. From experience and from every mathematical deduction it did not seem to him that the insulated joint was a solution of the problem, the solution being rather in the

offering of a good path for what current the pipe must carry, and also offering a metallic current for that current to get back to the earth.

Mr. D. McDonald, Louisville, Ky., said he did not want to see the discussion closed with the gas men admitting that they were either compelled to have their pipes eaten up with electrolysis or to let the electric street railways use them for the return of the current to the power house. His opinion was that the street railways would eventually be compelled by law to take care of their current.

The President asked Mr. Rice to close the discussion, which Mr. Rice did as follows: Mr. Shattuck names a figure of 1¼-horse power per 1,000 feet of gas compressed. As this figure had been named before, in connection with this particular installation, when I came across it I attempted to verify it. To save time I took three places and calculated them as nearly as I could, and they all seemed to converge in the figure named in the paper, viz., at 30 pounds compression the theoretical figure is 1.35-horse power. To that we have to add the loss in friction, which is the efficiency of the machine lost through the valve, which should be very slight, but the clearance losses are very considerable as the pressures rise. It is only fair to say that the statements in the paper about graded pipes refer to distribution centers and not the main pipe line. All of our main pipe line is graded. We feel if it is properly graded and taken care of we will not have trouble in our distribution centers, and our experience has justified that, as we are not having it. Should the trouble occur they can relieve the water at the saddles by putting in drips as they may prove necessary. There are two corrections to be made in ihe appendix—the Eastern Pennsylvania should be among the district governor systems instead of among the direct systems. The New Orleans pipe line is stated at 8-inch, whereas it should be 6-inch.

(To be Continued.)

Economic Waste and Competition.

[A paper read by Mr. W. S. Barstow, New York City, at the First Annual Meeting, Empire State Gas and Electric Association, New York City, October 31, 1905.]

In the history of every enterprise there comes a time when it either passes out of existence or takes its place as a recognized permanent industry. During this constructive period, if a public service industry, it is vitally to the public's interest to contribute in every way possible to its progress, duly recognizing that the capitalist is risking his money, time and ability during this what might be termed "crisis" period. How often have we seen a thoughtless or untimely act on the part of some community kill an infant industry, whereas the very existence of such was a direct benefit to the community. Such a step on the part of the public has in the majority of cases been taken through lack of knowledge as to the nature of the industry with which it was dealing.

A company has been granted a franchise, not in a spirit of philanthropy, but in order to benefit the community granting it. As time goes on, the community, at first friendly to the company, gradually becomes antagonistic and at last the breach is so widened that a new franchise is granted to another company in hopes that the last friend will prove more steadfast than the first, thus generally introducing indiscriminate competition. At this point two errors have been made: First, the error on the part of the first company in not recognizing that it is a public service corporation, that it owes its existence to the public, and that the public is entitled to some recognition. Second, the error on the part of the public in not acquainting itself with the nature of the industry and, without any inquiry, bringing a new factor into the field in the hopes of correcting an existing evil.

Before dealing directly with this subject let us glance over the past history of the more recently developed public service, that of supplying electricity.

The industry of electricity supply might be stated to have had its beginning on a commercial scale in the early '80's. Prior to that time the development of the science (as it was not a recognized industry) was more or less experimental and interesting only from this standpoint. The first electricity supply companies were, from a financial standpoint, decidedly speculative. Only those who could afford to part with their investment without inconvenience would consider lending their aid, and as often happens in the development of a branch of science into an industry, many of the early promoters and inventors fall in the struggle, their own enthusiasm causing their downfall. Since the early '80's the industry has passed through successive stages of construction and reconstruction, reaching not more than 15 years ago a degree of permanency and beginning to attract the attention of the capitalist in general. Up to that time no more errors had been made in the development of the science than are made in the development of any art. All attention and efforts were devoted to the first principle of *any* industry—"to make it work." This was the foundation of its existence. No one ever inquired into the expense "of making it work," not even the capitalist himself. It was recognized that a certain service was being performed and the charge was made accordingly.

After this constructive period there came the necessary refinements; the capitalist having overcome the practical engineering difficulties began to realize that he never knew whether he was operating his business at a profit or a loss until some time after either had actually taken place.

The public on the other hand, suspicious of the company on account of some trivial grievance and also readily supposing that it had been unfairly treated, turned to new friends in hopes that in so doing, in some way or other an advantage would be gained. It was an instance in the case of the operating company and the public where "familiarity breeds contempt." Instead of endeavoring to correct the condition by educating itself to a point where it could understand whether or not it was being fairly treated, the public assumed that it was unfairly treated and introduced indiscriminate competition in the hope that in the "survival of the fittest" some benefit would be gained. The inevitable took place. The new company, at first favored by the community because it was new, entered actively into a struggle with the old company, until both found that the field was too restricted for a double investment and that mutual interests could be better protected by combination. This left the public in the same position it was at the time of granting the first franchise, except that through such combination the companies demanded of the public an interest on double the investment necessary to supply, thereby tending to increase the price for the service.

The electrical supply industry renders a service and does not manufacture a commodity. This fact has a vital bearing upon the price and is the principal basis upon which a final decision must be arrived at. The ordinary manufacturer has an unlimited field, and goods manufactured do not bear a direct relation to the demand at any one time. Thus after a manufacturer has established his business in an unrestricted field he can manufacture in quantities at a stated output and on the most economical basis. Farther than that, he can adopt local conditions best suited to the manufacture of the product in which he deals. He can, if not suited with the cost of power and labor in one place, consider the moving of his factory to another place where he can secure cheaper power and labor.

An electrical supply corporation on the other hand is definitely restricted in its field. It has a large investment in its distributing system, the interest on which is independent to a very great extent of the business actually done. It must adapt itself absolutely to local conditions as they exist in the community in which it is doing business, and cannot take advantage in any way of local conditions outside of this territory. It is unable to manufacture at a stated output and must adapt itself to conditions which are fixed by the customers themselves; in other words, it has but a very slight control over the conditions under which its business as a manufacturer is conducted or the conditions under which its goods are manufactured. It is not supplying a commodity which can be dealt out to the customer as hardware, but is rendering a service, in that it must at all times be ready to furnish its goods to the customer upon demand and under certain conditions, and can then and only then begin the actual manufacture. It is not only manufacturing and selling kilowatt hours, but is delivering such to the customer under a condition or at a voltage demanded by the customer. It is not selling 1,000 cubic feet of gas, but is selling a quantity of gas at a certain pressure. The public fixes and clearly defines the service to be rendered. In other words, the electrical and gas supply industries can be classed as the telephone industry, where the readiness and ability to serve make up a large part of the cost of such service, and where an *increased* output may increase or *decrease* such cost to serve, depending upon the conditions under which such increased output is demanded.

An electricity supply corporation builds a plant to supply a certain community. The demand of that community at any one time fixes the nature, size and capacity of the generating and distributing plant, and so fixes the initial investment. The quantity or amount of energy supplied has no particular bearing on this item. Whether the energy is used one hour per day, one day per year, or whether 24 hours per day 365 days per year, the investment is fixed by the maximum demand of the one hour and the one day. We further find in the operation of the plant, after its construction, that there are also items which, like the interest on the investment, are independent of the quantity or amount supplied. Thus in a steam plant there is necessary a large expenditure

for labor, for fuel, repairs to machinery, besides labor and material necessary to maintain a complete distributing system, all of which is independent of the quantity or amount of energy supplied.

If we properly segregate the cost of electrical energy in an average community we should find that the service to those customers using the installation but a short period each day is extremely high and that nine-tenths of it is made up of "standby expenses" or those incurred in readiness to serve. As probably two-thirds of a community use their installations during these short periods, this fixes the maximum price for service below which figure the company can only supply at a loss.

Let us turn now to another question, the capitalization of a company and its earnings, both of which bear directly upon the question of competition.

No commission or body of men outside of the corporation itself can ever be given the power to definitely fix capitalization or regulate earnings without driving the investor from the field and without at once placing a premium upon ignorance, carelessness or mismanagement and striking a blow at ambition which is the foundation of any industry's growth.

Let us suppose two public service companies, A and B, begin business under exactly similar conditions, each in a different city. A carefully studies all engineering problems, purchases only what he requires and that economically, manages carefully and succeeds in building his plant, ready for business, for let us say $100,000. B, ignoring all engineering problems, purchases extravagantly, manages carelessly and his plant costs him $150,000. A, with the same ability and forethought with which he constructed his plant, earns above expenses $10,000 (which is 10 per cent. on his investment). B, continuing his wasteful policy, earns above all his expenses $9,000 (or 6 per cent. on his investment). Can any commission or law of the country state to A: "Because you are earning more than B you must reduce the price of current?" Can any commission say to B: "Your $150,000 could not possibly have been the cost of your plant because A's cost for a plant to do similar work is only $100,000?" If the public thinks because A earns 10 per cent. on his investment that the price of service is too high, simply because the return is a little above the average, it has a perfect right to grant a franchise to another who will sell current for less because he is satisfied with a smaller return, *but in this the public must use discretion.* It must itself, or through a commission, institute a careful inquiry *before* granting such privilege; it must investigate carefully how the newcomer expects to better the conditions. In the case of A this can only be done by reducing the investment below A's by reason of recent improvements in the art or reducing the expenses below A's because of recent improvements in the methods. But if A is properly managing his business (which we assume he is) he would already have adopted such improvements in the art or methods and would have done so without impairing his original investment. The only thing left then is that the newcomer is satisfied with a smaller return upon his investment than is A. In the case of B the newcomer would have a better chance, for he has only to build a plant with the same ability as A and operate under the same improved methods in order to profit by B's mistake. In the meantime it remains with B to correct his mistakes, make improvements and restore his impaired investment before suffering competition. No new *responsible* newcomer would enter such a field or accept such a franchise, unless he had carefully studied the conditions which existed in the community and knew that he could improve the situation both for himself and the public, and no public or community should ask him to enter the field unless they were equally sure he is responsible and that the situation can be bettered thereby. The duty, therefore, of the public or commission is not to fix capitalization or adjust earnings (as these must necessarily be taken care of by the companies themselves) but to so far inquire into the conditions of service as to determine whether competition *will improve* the situation, or as has generally occurred in the past, bring about a set of conditions which will retard the growth of the industry and cause a serious loss to the public.

It is a campaign of education, for as the public has been gradually educated by the company in the use of the service so it must become further educated as to its nature. It is not a question which can be argued or settled in the heat of a political campaign. It is a plain business proposition and should always be treated as such.

The Price of Coal Gas to Possible Users of Suction Gas and Others.

[A paper read by MR. THOMAS NEWBIGGING at the last meeting of the Manchester District Institution of Gas Engineers, Stockport, England.]

Old fallacies crop up every now and again under new disguises; and it is well to look them full in the face to prevent our being misled. One of these fallacies is the assumed wisdom of allowing excessive discounts to certain consumers.

It is not generally recognized that statutory gas companies hold their works and maintain the virtual monopoly of their several districts, not simply and solely for pecuniary gain, but largely for the benefit of the public who are gas consumers; and that when a reasonable interest on capital has been earned and paid, and a reserve fund created, the resulting surplus profits (if any) are due to the consumers as a body. Hence the restrictions and limitations imposed by Parliament upon these enterprises. That is, broadly speaking, the law in regard to gas supply as affecting companies. In some private gas acts discounts are enjoined to certain classes of consumers. But this is the exception, and it only serves to show the loose and irregular way in which private bill legislation is sometimes conducted.

In the case of local authorities who possess gas undertakings, the restrictions as to profit are not so close; more latitude being allowed, doubtless under the impression that, the element of personal gain being eliminated, there was no temptation to secure profits beyond what were needed to pay interest on capital and provide a sinking fund to redeem such capital within a given time. That the legislature was mistaken in this is proved by the fact of the large balances of profit that are carried to the general fund in aid of the rates; such contributions from the gas coffers acting as a kind of buffer to mitigate the blows that would fall with greater force than they now do on other of the civic departments for their blunders, or extravagancies, or misdirected ambitions. There can be little doubt that, when a revision of the Acts of Parliament relating to gas supply takes place, there will be a limitation of the powers of local authorities in this respect. The Scotch Burghs are so limited now by the Burghs Gas Supply (Scotland) Act, 1876; no profit being allowed to be made by their gas departments beyond what is required by way of interest and sinking fund.

But the clear, patent, unmistakable intention of the Legislature in regard to companies, and also to a less extent in regard to local authorities, is continually being circumvented by the policy adopted in many cases of allowing these excessive discounts to certain favored consumers, the effect of which is to lay upon the shoulders of the large body of consumers a burden which they should not be called on to bear. Reasons more or less untenable are urged in favor of this mistaken policy. I grant that for large consumption a reduction in price is allowable and justifiable; but it should be to a reasonable extent only—a reduction that will be equivalent to the cost of collection, a possible reduced leakage, the lessened risk of bad debts, a slightly less capital outlay for service pipes, and an item for reduced maintenance.

The suction gas producer plant is the latest competitor that has come to disturb the gas manager's peace of mind; and it is being held over him as a *flagellum* which will come down on his head if he does not "fork out the dibs." What then is to be done? The aim in my opinion should be, not to compete with the suction plant by selling the present high illuminating gas at a loss, merely for the sake of gaining or retaining business (that way bankruptcy lies, and injustice to others), but to produce gas that can be sold at a competition price and yet yield the full profit on the sale. Such a gas could undoubtedly be made, provided the restrictions as to illuminating power were abolished and the use of the incandescent mantle were universal. We have not yet attained to that *desideratum*, though we are on the road leading to it.

Things have not come to the pass that, "While the grass is growing, the horse is starving." Alarmists seldom stumble on the right remedy. A healthy competition is good. It keeps one on the alert. The advent of the electric light gave a needed stimulus to gas progress; and the suction gas plant has already exposed some weak spots, while emphasizing the remedy and hastening its application. Meanwhile, it is some consolation to know that, for the smaller engines, coal gas at the prices which prevail in most places is the cheaper fuel because of its handiness, its trustworthiness, its cleanliness and safety, its greater heating value, the non-requirement of labor—whether skilled or other— in its application, the fact that no capital expenditure is entailed in its adoption, and with, of course, an absence of wear and tear. But even if this should not be so, rather than allow the exorbitant reductions called for, I say give the would-be suction gas consumers the go-by; the terms they are being encouraged to demand are too onerous to pay for their custom. I have known diamonds to be bought to dear.

The other day, speaking on the subject to one of our gas engineers, he stated that his company were supplying the would-be gas consumers at the rate of 1s. or 1s. 2d. per 1,000 cubic feet—I forget which.

"Yes," was my reply, "you are supplying them at a sacrifice of the dividend, or some portion of it."

"Oh, no," he retorted, "we are paying the full 10 per cent. to the shareholders." (As if that was a clincher to my suggestion.)

"At whose expense is this full dividend being paid? Clearly at the expense of the other consumers—those who burn gas for lighting at night, and those who use gas for cooking by day."

"Oh," my friend replied, "but there are certain fixed expenses that will be the same whether you supply the favored low priced consumers or not."

"Indeed; and why should the consumers of gas by night for lighting and the consumers of gas both by night and day for cooking, be saddled and continue to be saddled, with all the fixed expenses, and the others allowed to go scot free? Where would be the covering profit to clear the fixed expenses, if it were not for the consumers of your commodity for lighting and cooking?"

"But you forget that, with a large day load, less capital expenditure per 1,000 cubic feet is required."

"Less capital expenditure; on retorts? Certainly not. On purifiers? Assuredly not. On the fixed plant, such as exhausters, condensers, washers, scrubbers? No, certainly. On storage capacity? Yes, possibly, a trifle less holder room, proportionate to the make, would be needed. That even is questionable. I do not advise such close sailing as some clever managers, who profess themselves content with ⅓, or ¼ of a day's storage. Give yourselves good elbow room in this respect, and you will not only work cheaper, but you will sleep all the sounder for it at night—no small matter in these days of stress. It is sometimes claimed that there is a saving as regards the size of the mains in proportion to the consumption. But that is not so. Day consumption alway overlaps the night consumption more or less; and when it does so for however short a time, the mains must be of a size to meet both consumptions.

"Increase the day load by all legitimate means, but do not follow the example of the electricians, who make a fetish of it—as they are almost compelled to do by the circumstances of their case. Some of them sell their current for use in the daytime at a positive loss (and I observe a tendency in the same direction among gas authorities), thus involving themselves in difficulties from which they will hardly emerge with credit. The day load, desirable enough, is not of such tremendous import to the gas manager as it is to the electrician, by reason of his being able to store the day's make. It is this valuable capability of storage, so enabling him to utilize the whole of his producing plant during the daytime, which gives the gas manager marked advantage over the electrician. The latter has no means of storage, except to a very limited and imperfect extent; and so not only his mains (as in the gas manager's case) but also his producing machinery, or the bulk of it, in the absence of a dayload, is lying idle for, on the average, half the 24 hours. This offers an excuse for, if it is not a justification of, his frantic efforts to secure a full day load by hook or crook.

"I cannot accept the dictum of some, that if (their is much virtue in an 'if') all the consumers were 24 hours' consumers, no holder storage would be required, unless they will, while using the argument, undertake a revision of the solar system, and so reconstruct it that there shall be, instead of a diurnal period of darkness, a 24 hours' daylight. It is evident (to me at least) that where there is a large number of 24 hours' consumers—say, one-half of the whole—there must be a corresponding increase of storage room. If the argument of these gentlemen is right, the opposite should be the fact; and if they acted on the strength of their argument and curtailed the storage by reason of one-half of their consumers being 24-hour consumers, they would soon be found praying that these 24-hour men would cease their consumption during the time of darkness, so as to prevent the grounding of the curtailed gasholders."

"Yes, but the storage is required by reason of the night consumers coming in at dark."

"That is only partially true. It is because of the conjoint consumption of the two under the conditions of our plant—the one just as much as the other. It is evident (to me again) that, assuming the 24 hours' consumers did cease to consume when daylight disappeared, less storage room would be required than if both the night and the day consumers pursued their consumption conjointly.

"But let us turn the table, and take stock of the rights and wrongs of the question from another point of view. Here, again, my contention holds good. Supposing that you were blest with a full day load, and deprived of your night load, in what predicament would your day loaders be? They would, of course, have to bear the full burden of the fixed expenses just as the night loaders have done from the beginning; so that it is only by reason of the night and light consumers bearing the burden that the others can be relieved, as is sometimes proposed.

"It is commonly assumed that the lighting consumers make use of gas during only the hours of darkness in the evening. This is far from being the fact. There is in all considerable towns a large consumption of gas in the daytime in dingy offices, in the back part of shops, in staircases, and in cellars and basements: and, as we all know, there is often in foggy weather an uninterrupted burning of gas during the whole day. In addition to these, a consumption by no means small takes place in the daytime in winter in the warming of rooms by lighted jets. If it were possible to allot the consumption of gas in the daytime to the different consumers, it would be found that a large proportion of it is due to those who use gas in the way that I have named. All this is ignored by those who coddle the special day consumer in the matter of price.

"It stirs one's gorge to see these extravagant reductions made to certain favored consumers for what they call trade purposes—as if the light used by shopkeepers and by a hundred others was not for trade purposes. I should like to know the composition of some of the boards and councils (especially in small towns) who vote these extravagant variations in price. It is simply, so far as it goes, a way of trading on other people's money. If consumers generally were alive to their interests, they would join in protest. Unfortunately, when they do attempt to criticize gas administration, their strictures are often ludicrously wide of the mark and applied to the wrong persons—which is a pity."

"But what about winter consumers who do not consume gas in summer? Are not the all-the-year-round consumers of more value to you than these?"

"Yes, truly; but the consumption of the first being limited to the dark months of the year is a good reason for refusing such consumers an excessive discount. It is no reason at all for allowing an exorbitant reduction in price to the other. But, mind you, it is not entirely disadvantageous to have these winter consumers. In the absence of their consumption in summer, the manager is enabled to put his set-down plant in good order. Again, with nothing but all-day and all-the-year-round consumers (assuming that such a thing were feasible) he would need a considerable surplus of carbonizing and other plant, even if he required less holder room."

"When all is said and done, we sell at a reasonable price to the ordinary consumers, and therefore no harm results."

"The price ceases to be reasonable to the ordinary consumers whenever another obtains a supply at a figure that does not pay its way to the last penny of dividend."

"But the mains are standing idle, or partially idle, during the daytime, and we want to employ them more fully."

"So does every sensible manager. But notwithstanding that they are idle, or partially so, the ordinary consumers provide the profit which pays the full interest or dividend upon the capital invested in the mains that are lying idle in the daytime."

"If we refuse to supply the would-be suction gas consumers at their price, we shall lose their custom and any profit arising from it."

"That is to say you will lose the chance of supplying the would-be suction gas consumers at a loss, which loss would have to be recouped by keeping up the price to ordinary consumers. You might even have to raise the price to ordinary consumers, though it is possible that the natural growth of the consumption would soon obviate this—and then there is the reserve fund to fall back on, which fund has also been provided by the ordinary consumers, except where it has been accumulated under the sliding slace. But you would certainly lay a tax on the ordinary consumers by your inability to reduce the price to them, owing to your taking on other consumers who do not pay their way.

"Assuming, for the moment, that by so reducing the price of gas to an unpayable extent—that is, to an extent that would not cover interest on money and dividend as well as working expenses—you secured all the would-be suction gas consumers, and by so doing added, say, 50 per cent. to the consumption (the principle is the same whether 1 per cent. or 100 per cent.), it is clear that an increase of capital on additional plant would have to take place. Seeing, then, that the low price proposed to be charged would not pay interest, or only a part of it, on the capital, even if it covered the working expenses, the burden of paying such interest in full would again fall on the ordinary consumers, and their prospect of a reduction in the price of gas would be indefinitely removed. Where is the justice of such a proceeding?"

"If you are determined to make these unfair reductions, might I suggest that, instead of thus taxing the ordinary consumer, you meet the difficulty by sacrificing part of the profits? It is not right to throw the onus of providing the whole of the profit or dividend on the shoulders of the ordinary consumers, under the circumstances named. If you forfeit profit to retain the custom of the would-be suction gas consumers, then you ought to be prepared to sacrifice dividend accordingly, and not compel the ordinary consumers to make up what you lose by so doing."

But I need not pursue the conversation further. Turn it and twist it as you will, I say that to make these gross distinctions among consumers is bad policy. The casuistical arguments that are used to justify these reductions at the expense of others are based on false premises,

and are injurious to gas progress. But it is sheer waste of words declaiming against the illogical arguments that are started like so many hares across one's path—or, rather, it would be a waste, were it not that their authors deceive others as well as themselves. It is also folly discussing these hairs-breadth differences between the various classes of gas consumers—something can always be said for and against any of them. But they are all interdependent; and he is wise who advocates a uniform price all round, with, as I have said, a moderate discount upon a large consumption.

I am far from wishing to underrate the threatened or actual competition of the suction gas plant. On the contrary, I believe that, for industrial purposes, it has come to stay. It is one of the cleverest and simplest inventions of recent years. It will be a greater competitor of electric lighting works and steam engine works than of gas works. The invention is not only good in itself, but it will exert a stimulus on coal gas enterprise. The facts may be faced by far-seeing managers without flinching, though listening to some of the discussions that have recently taken place on the subject one can only conclude that not a little hysterical talk is being indulged in. One manager believes that coal gas will have to be sold at 1s. per 1,000 cubic feet to compete with suction gas; and he would be prepared to supply at this price rather than miss the order, in the hope of ultimately benefiting by retaining the business. I suppose that, to be logical, he would even sell at 9d. or 6d. per 1,000 feet, if these prices were required in competition.

Well, all I say is that I would not follow that example—unless, indeed, like our friend Carr, at Widnes, I could do it without putting a disability upon someone else. (Happy man, my old *protégé* Mr. Carr to-day, with no fear of the competition of suction gas before his eyes. Verily, patient persistence in well doing is having its reward!) The ordinary consumers—in the case of undertakings belonging to local authorities—have all these years been milked to provide the big balances of profit that go in reduction of rates, besides contributing towards redeeming the capital within a given number of years; and now it is being proposed that they shall be further mulcted to aid in the competition against this blithe newcomer, suction gas.

Reduce, if it be possible, but not at another's expense. It never seems to occur to those companies and local authorities who allow or are prepared to allow the extravagant reductions in question to forego (as I have already suggested) a portion of their profits by a corresponding reduction all round, so as not to allow the burden to press upon the regular ordinary consumers. What is sauce for a goose is sauce for a gander. The usual excuse is not satisfactory—viz., that they are anxious to secure custom and circumvent an opponent with a view to future advantage. It is easy to put on a bold front and adventure something at another's expense. The notion is, apparently, to reduce the price as a temporary expedient, in the hope that the higher price may be restored at some vague, future time. The idea is fallacious. Once a reduction, always a reduction. Attempt to restore the price, and the suction gas plant will be dangled over your head more furiously than ever.

In the case of works the price of whose gas is comparatively low—say about 2s. and under per 1,000 cubic feet—there is a chance of competing without doing injustice to other consumers. But gas works belonging to either companies or local authorities where the price from various causes is bound to be higher, may be considered out of the running; and these must be content to find that they cannot compete under present circumstances with suction producer gas. As a rule, however, such works are not called upon to compete. Certainly they would not improve their position by attempting it. If they did not make such a reduction as would secure the possible suction gas consumers, the result would be to stereotype the higher prices charged to the great bulk of the existing consumers, unless the works happened to be in a rapidly developing district.

One further point. A concern—especially a small concern—takes considerable risk in supplying (that is, in providing the capital to supply) a few very large consumers. In the event of these ceasing their custom, the gas authorities would be placed in severe straits. This element of risk should not be ignored in setting the price to be charged. In the light of this consideration, it is plain that very large consumers are not the safest and most desirable customers, but that a number of smaller consumers give greater stability to a concern. This is no fanciful and far-fetched example. I have in my mind the circumstances of an actual case that occurred, where a company, having provided the necessary plant, were landed in sore straits by the defection of their largest consumer. I know of another case in a maritime town, where a government department holds the whip *in terrorem* over the concern that supplies the dockyards with gas, by threatening to manufacture its own light if certain unreasonable terms as to price are not conceded.

There are other substantial considerations that should weigh in settling the question of price. It may well be remembered that the ordinary lighting consumers have been the very sheet anchor and mainstay of gas enterprise. It was on them that the strong foundation of the business was laid; and (leaving out of account the very smallest consumers) they are the Atlas who really bears the superstructure today. Taking them in the mass throughout the country, their consumption of the chief commodity in which you deal far outstrips in quantity that of consumers of the same commodity for other purposes. Do not overlook the fact that the lighting consumers are the backbone of your business, and let them have the full benefit whenever a reduction in price can be made. It should never be forgotten that the competition with electricity in dwelling houses, shops and other business premises is persistent and insidious in its growth; and the aim of every gas manager should be to meet this competition with a reduced price for gas to all consumers alike.

Of course, if you cast every argument to the winds, and still determine to pursue a policy of unfair reduction to one section of the consumers, which means the continuance of unfair inflation to the other sections, I have nothing more to say, excepting that your policy will sooner or later find its Nemesis.

Finally, let me add that the extension of gas consumption by cheapening cost under good management, by the removal of every hindrance to its universal use for cooking and heating, a reduction in the illuminating power to cheapen production, and, concurrently therewith, the widest possible use of the incandescent mantle, will go far towards enabling the gas manager (provided he is not unduly hampered) to compete against his rivals without doing injustice to any section of the consumers. These are almost commonplaces to urge to-day, but nevertheless he is a wise manager who treats them as essentials.

Notes on a New Purifier Grid and Purifying Materials.

[A paper prepared for the last meeting of the Manchester District Institution of Gas Engineers, by MR. H. KENDRICK, of Stretford, England.]

Having been favored with an admirable paper by Mr. J. C. Belton, on his experience with Jäger grids, the committee asked me if I would relate my experience with Spencer hurdle grids; and this, after having failed to draw another member, I consented to do. As, however, we have only 1 box in operation, and that has only been working a few months, the information at my command is not as full as I could wish.

The purifier fitted with the Spencer hurdle grids is one of a set of 4 water lute 20 feet by 20 feet by 5 feet boxes, worked by a center valve of the usual dry faced type. They are fixed on girders, with a revivifying floor underneath, are provided with bottom discharging shoots, and are fed by old bucket elevators, which discharge the oxide into shoots only 4 feet 6 inches higher than the edge of the box lute. This involves having a man with a rake stationed at the shoot to pull down the oxide into the skips by which it is carried and deposited in its place in the box. This arrangement will be simplified next season, by carrying the elevators higher and having the oxide distributed from a band conveyor through a canvas shoot. There are no structural alterations required to the purifiers, and the cost of a set of hurdles fixed is under $200 for a 20-foot square box.

Arrangement of the Hurdles.—In the box the hurdles are arranged on a tier of ordinary grids 12 inches from the bottom of the box, in five rows, the two outer ones on each side being inclined from the vertical to the extent of 20°, commencing at one side with three special grids cut to suit the box and to give the desired angle. After these first three the hurdles are all one pattern, until the opposite side of the box is reached, when three special grids are used to complete the square. For the purpose of avoiding excessive handling, the inclination of the two outer rows on the left hand side is opposite to the inclination of the two outer rows on the right hand side. The center row of hurdles is dealt with differently; and, in placing in position, we start with special hurdles in the center of the box, and place in the ordinary hurdles in opposite directions until the sides are reached—using the same special grid to finish off with as in the outer rows.

The hurdles, when placed in position, entirely fill the box, with the exception of the gas-way at the bottom, and occupy a space of 4 feet from the ordinary flat grid at the bottom to the top of the lute plate; and the box has the appearance of being filled with laths of wood. The hurdles are so constructed that a lath in one row is directly below a space in the row immediately above it, and so prevents the full pressure of the material from pressing downwards on to what I may term

the floor of ordinary grids. There are seven triangular laths in the depth; the space between each tier being just under 7 inches. The space from one lath to the next immediately above cannot be more than 14 inches at any time, and the pressure exerted on the material cannot be more than 14 inches; but as the purifying material shows a distinct tendency to form an arch from one horizontal lath to the next, it is practically certain that the pressure exerted on any part of the mass of material is no more than will be due to 7 inches of material between it and the next horizontal row of laths. We found the material upon examining after filling ½, was quite loose at the bottom of the box, as, owing to the construction, it is impossible to pack the oxide. The greatest fall the material has from one lath to the next below it being 7 inches, it must of necessity be loose. My own fear, when first filling, was that the material would not run to the bottom, and that we should have to space the hurdles farther apart, but I have to confess that my fears were groundless, as when emptying I personally examined every row and could not find an empty space. The filling seemed perfect, as was also the sulphiding of the material.

Filling and Emptying.—The process of filling with us at present is to pour the oxide from the skips on to the top of the grids until the material is 3 inches over the top lath; and for emptying we remove the center row of hurdles first, as the discharging shoots are situated under these, near the outer edge of the box. This row of hurdles has to be taken right out of the box, as the space is required for working at the other four rows. Very little difficulty is experienced in taking out the special hurdles, and after these are removed the ordinary hurdles only require shaking slightly to loosen them. No pick has been required to loosen the material at any time, and it is much more easily dealt with than with the old type of grid. In removing the material from the other row of hurdles, it is necessary to proceed rather differently; and only about ¼ of the hurdles in these four rows are removed from the box. After this the remainder are merely reversed and placed in position behind the men as they proceed with the emptying; so that actually only ¾ of the hurdles have to be lifted in and out of the box each time. This will, of course, greatly reduce the wear and tear on them, which would be heavy if they all had to be lifted out and stacked each time. We found it necessary to leave plenty of room for expansion after the first time of filling; and in addition to leaving a hurdle out of each row, reduced the width of the center row by 2 inches. The mass of wood absorbed so much moisture, and swelled so greatly, that it was with difficulty we removed the first few hurdles. Since leaving more room we have not experienced any difficulty at all.

The other purifiers have only one tier of grids in, and the oxide is placed on them in one layer 2 feet 9 inches deep. This has been the practice at Stretford from time immemorial, and as we have not been until lately very much troubled with back pressure, I have not altered it. Last winter, with oxide containing over 30 per cent. of sulphur, one set of 4 boxes purified 850,000 cubic feet of gas per day, and gave 10½ inches back pressure. At this stage it became troublesome; and we put the second set of four 20-feet boxes to work, when the back pressure immediately fell to 1½ inches. So far this winter we have not found it necessary to put the second set of boxes to work, though our make has reached 1,100,000 cubic feet per day; while the maximum back pressure given by the three boxes filled in the ordinary way was 4.1 inches, and that given by two ordinary and the Spencer box, when the Spencer box was the middle box, was 2.1 inches, and when the Spencer box was first box, 1.3 inches.

Some Statistics.—The amount of material placed in the boxes was as follows:

Ordinary grids.....22 tons.
Spencer " .....28 "

The cubic space occupied by each was:

Ordinary grids.....1,100 c. ft., or 50 c. ft. per ton.
Spencer " .....1,700 " " 61 " "

The quantity of gas purified by the boxes per change has been:

Ordinary grids.....5,752,000 c. ft. = 261,000 c. ft. per ton.
Spencer " .....8,207,000 " = 293,000 " "

The labor in emptying and refilling per box has averaged:

	Emptying.	Refilling.
Ordinary grids	20 hours	35 hours.
Spencer "	28 "	44 "

A total of 55 hours' labor, including removing and refixing cover, for the purifiers with ordinary grids, and 72 hours for the purifiers with Spencer grids, which works out, per ton of material dealt with, to—

Ordinary grids..... $\frac{55}{22}$ = 2.5 hours,

Spencer grids..... $\frac{72}{28}$ = 2.6 hours,

or practically the same. While on the gas purified it works out per million cubic feet—

Ordinary grids..... $\frac{55}{5.752}$ = 9.6 hours.

Spencer grids..... $\frac{75}{8.207}$ = 8.8 hours.

Therefore, though the labor costs per ton are slightly higher, owing to the handling of the grids, the labor costs per million cubic feet of gas purified shows a saving of practically 10 per cent. Where the oxide is placed in the purifiers in two, three or more tiers, the saving would be greater. The greatest feature, however, is that with the same sized box we are enabled to purify 1,455,000 cubic feet of gas more per change, or an increase of 25 per cent., thus decreasing the capital charges for purifiers to this extent.

I have not the slightest doubt that with all the boxes in one set converted to this system we shall materially reduce our labor costs and increase the gas purified per box. There is, however, one doubtful point that only a long experience will prove, viz., the cost of repairing and renewing the hurdles. They are considerably more fragile than the old type of grid, and will, I am afraid, at least swallow up any saving that we may obtain in labor costs. But there will still remain as an advantage the absence of back pressure and reduced capital charge.

Purifying Material.—In deciding upon the particular brand of oxide out of the many offered, it is necessary to take into consideration the cost of working, besides the usual items of price, cost of delivery and discharging, and percentage of moisture, organic matter, and hydrated ferric oxide. Some oxides that appear cheap because they can be delivered at a lower price than others are dear at any price, and *vice versa*. I had an experience with a natural oxide that contained over 60 per cent. of uncombined water that I do not wish to have again. I also had an experience with an artificial oxide that would not take up sulphuretted hydrogen until it had been through the boxes once. We cured this by mixing with it about 20 per cent. of partly spent oxide.

Revivification.—Apart from all this, and the ease with which some oxides take up sulphuretted hydrogen, there is one matter that is often overlooked—namely, the cost of revivifying. Some oxides revivify very quickly, others slowly; and in order to determine which was the better for our purposes, and settle once for all the rival claims, we procured sufficient new oxide to fill 2 boxes, prepared for use by the vendors, from each of 3 separate firms. These different oxides were kept separate up to the time of their being spent and sold as spent oxide, and a record was kept of the gas purified, sulphur contents, and labor spent on each; with the result that we have bought the oxide that was highest in price ever since. As will be seen from the following tables, it was not even the sooner sulphided; but the advantage lay in the readiness with which its revivification took place. So rapid is this that with new oxide it has either to be watched constantly or immediately spread out on the revivifying floor.

TABLE I.—*Artificial Oxide.*

Turns in Box.	Sample A. Gas Purified. Thousands of Cubic Feet.	Sample A. Percentage of Sulphur Dry.	Sample A. Percentage of Moisture.	Samp'e B. Gas Purified. Thousands of Cubic Feet.	Samp'e B. Percentage of Sulphur, Dry.	Samp'e B. Percentage of Moisture.
1	3,674	9.4	31.2	3,674	8.4	28.9
2	7,260	23.7	21.3	6,839	21.7	18.8
3	10,951	32.9	8.6	8,004	32.4	11.2
4	10,692	41.7	9.0	13,296	38.9	8.3
5	3,422	43.6	7.3	8,917	41.3	3.7
6	7,511	44.0	9.0	8,236	43.9	10.6
7	7,416	45.4	11.8	6,770	45.0	7.6
8	7,129	49.3	7.3	7,416	46.7	10.8
9	6,737	50.8	10.7	6,533	48.5	4.8
10	8,347	51.9	6.3	7,730	49.5	10.0
11	7,435	53.9	7.4	8,297	52.1	10.7
12	3,429	54.6	9.2	6,292	54.0	10.0
13	4,565	55.8	10.0	6,335	55.1	11.0
14	.....	....	....	5,064	56.0	10.1
	91,866			103,401		
Average.	7,067			Average.	7,386	

TABLE II.—*Artificial Oxide.*

Turns in Box.	Sample C. Gas Purified. Thousands of Cubic Feet.	Sample C. Percentage of Sulphur Dry.	Sample C. Percentage of Moisture.	Sample D. Gas Purified. Thousands of Cubic Feet.	Sample D. Percentage of Sulphur. Dry.	Sample D. Percentage of Moisture.
1	2,719	26.0	21.8	1,116	18.8	33.0
2	5,619	33.7	25.1	6,890	26.9	25.0
3	10,963	37.7	20.9	11,744	34.8	15.4
4	9,933	40.4	10.4	13,441	40.9	19.3
5	2,815	42.2	13.3	9,600	41.8	11.9
6	6,397	43.9	5.4	4,739	45.7	8.3
7	2,720	47.2	10.9	3,147	46.9	10.0
8	6,257	48.9	11.4	5,885	49.3	6.5
9	3,813	49.8	10 0	8,803	51.5	11.1
10	7,416	51.0	10.1	7,579	52.4	9 0
11	11,808	52.2	8.0	8,679	53.1	10.0
12	7,463	53.4	8.2	5,680	55.0	8.8
13	5,460	54.3	8.8	4,450	56.8	8.5
14	6,641	55.8	7.0	.....	....	...
	90,091			91,673		
Average.	6,435		Average.	7,052		

TABLE III.—*Natural Oxide.*

Turns in Box.	Sample E. Gas Purified. Thousands of Cubic Feet	Sample E. Percentage of Sulphur. Dry.	Sample E. Percentage of Moisture.	Sample F. Gas Purified. Thousands of Cubic Feet.	Sample F. Percentage of Sulphur. Dry.	Sample F. Percentage of Moisture.
1	10,152	21.2	38.8	9,207	27.7	34.9
2	6,680	26.6	21.2	3,979	30.1	32.4
3	12,118	34.6	21.0	8,457	35.1	14.0
4	8,643	38.0	28.7	12,062	39.8	15.4
5	4,340	41.4	20.2	6,327	42.0	10.0
6	7,576	42.6	13.2	7,790	44.4	11.0
7	7,363	45.3	14.6	11,931	47.3	7.0
8	6,126	49.6	8.1	7,050	50.2	8.2
9	6,339	51.5	7.8	7,532	52.9	6.4
10	7,148	54.1	9.0	7,391	53.6	4.4
11	6,023	56.3	8.0	6,925	56.4	6.4
12	7,538	56.8	3.3	7,979	58.7	5.6
	90,046			86,630		
Average..	7,504		Average..	7,219		

The accuracy of the amount of gas purified per turn is somewhat interfered with by the fact that during the winter we were compelled to have two sets of oxide boxes working in conjunction. The tests extended over a period of 22 months, and were all conducted by one of my assistants, who was responsible also for the sampling and analysis of the oxides. Both the artificial oxides contained originally 35 per cent. of moisture, and the natural oxide 45 per cent. Steam was admitted in small quantities into the gas during the winter at the scrubber outlet, to insure the ges being moist; and 1½ per cent. of air was admitted at the condenser inlet, so that a certain amount of revivification took place in the boxes. The curious point about all the data is that though No. I. was the least and No. III. the most active to begin with, yet all three samples reached 50 per cent. of sulphur in the same number of changes, and that the natural oxide was more active at the finish. Moisture does not seem to have assisted purification to a large extent, as witness the behavior of the two tests of natural oxide; but when the moisture fell very low the amount of sulphur taken up fell off also. Ten per cent. of moisture seems to be the limit. The percentages of moisture were calculated on the oxide as sulphided, not prepared for refilling; it being our practice to well saturate the oxide on the floor overnight to the extent of about 25 to 30 per cent.

Labor Costs.—The labor expended on the three samples varied considerably. The emptying and refilling of the purifiers for all the samples was the same; but the time occupied in revivifying was considerably less with sample No. I. than with either No. II. or No. III. Tabulated it is as follows:

	Cost of 45 Tons Unloaded.	Wages Paid for Emptying and Refilling Boxes.	Wages Paid for Revivifying.	Total.
I.....	£56 5 0	£32 13 8	£24 10 0	£113 8 8
II.....	48 7 6	32 6 0	44 6 4	124 19 10
III.....	46 12 6	30 5 0	47 6 8	124 4 2

The gain is not much; but the advantage must be ascertained from the amount of labor spent on the work; and, in my opinion, any material, though it costs more initially, that reduces labor on the works is a saving, as fewer men are required, and fewer men means less supervision and less wear and tear, the value of which cannot be calculated.

In placing these figures before you, I am actuated as much by a desire to gain information from my fellow members in the discussion which is to follow as by a possibility of imparting information to any of them.

Some Obstacles to Electrical Development in Great Britain.

By W. VALENTINE BALL, M.A , in *Elec. World.*

People in the United States sometimes wonder why the old country is so much behindhand in matters electrical. At least they wonder why the statement is so often made that, in spite of its having given the lead in these matters, England no longer takes a foremost place among the countries where electricity is used for light and power.

It is unnecessary for the present purpose to make any admission as to the truth of the above statement. Indeed, it would be the task of an expert electrician to decide which of any two countries was ahead—leader of the electrical world. Many circumstances would have to be considered; many causes, wholly beyond the control of the government or the legislature of a country might tend to retard its progress in this respect. A single illustration suffices. In a country where there is abundant water power, the ingenuity of the inhabitants will be directed toward transmitting that power from the mountain torrent to the manufacturing center. Naturally electricity is the chosen medium, and in the result an impetus is given to electrical development which is not experienced in a country where coal is abundant, and the necessity for transmitting power over long distances is not so apparent.

The absence of water power is a difficulty which it is beyond the power of man to overcome. If the natural advantages of one country outweigh those of another in one respect there is sure to be some compensating advantage somewhere else.

Other influences may, however, be at work to stem the tide of electrical progression. It is with these influences which have been at work in England ever since electricity became a power in the world that we propose to deal in the present article.

To indicate to the American reader exactly how electrical progress in England is checked by governmental and other interference it will be necessary to explain, as shortly as possible, the manner in which power to supply electricity (whether for lighting or power purposes) must be acquired.

Let us first take electric light. If a company is formed for the purpose of generating electricity to furnish a town or district it is practically necessary to obtain the sanction of Parliament. It is true that in England there is no reason why a private person or company should not supply electricity to his neighbors upon whatever terms he chooses; but in order to obtain leave to break up streets for the purpose of laying down mains and cables it is necessary to obtain the sanction of Parliament.

It is obvious that unless a supply company is allowed to carry its mains over or under the streets of a town, the scope of its operation must be very much restricted. What, then, is the procedure to be adopted in order to obtain the sanction of Parliament? Two acts were passed, in 1882 and 1888, respectively, which laid down certain general rules and conditions on which a "provisional order" for the supply of electricity may be granted. A provisional order is an order made by the Board of Trade which specifies the conditions under which the supply of electricity is to be given to the public; the notices which are to be given to those whose property may be interfered with by the uprooting of the streets; the maximum prices which may be charged to the consumer, and makes provision for the regulation and testing of the motors used by consumers.

The common and usual clauses in a provisional order are now to be found in the schedule to the Electric Lighting (clauses) Act, which was passed in 1899. This schedule is incorporated with every private act which regulates the supply of electricity, although in particular instances its provisions may be subject to modification.

A provisional order must be confirmed by an act of Parliament before it becomes law; but it may be mentioned that for a number of years past this confirmation has been a mere matter of form unless some clause of an unusual character made its appearance in the order. Note, however, that although it is in practice a mere form, the confirmation of every provisional order by act of Parliament is essential. Let us go one step further and see how a provisional order comes before Parliament for confirmation. The usual preliminaries having been complied with, the bill comes before a parliamentry committee who consider its various clauses. The promoters of the bill call witnesses in support of its provisions, and to show that a supply of electric light in the district is needful. Opposition may take the form of an objection to the principle of the bill on the ground, say, that the supply of electricity is not necessary in the district; or else opponents may object to particular clauses. For instance, a land owner might object on the ground that it was proposed to take a portion of his land on which to build a gener-

ating station. After it has been approved by a committee the bill then goes before the houses of Parliament, and is passed into law.

The parliamentary formalities which must be gone through in order to obtain the necessary power to supply electricity are not here described for the purpose of showing that they place serious obstacles in the way of the promoter.

The chief obstacles are those which are presented by the opponents, who, then, are the opponents to measures which, even if they were promoted by persons as a speculation, are incidentally of great public importance. It is the local authorities who have shown determined opposition; it is the craze for municipal trading in England which has formed the chief obstacle to private electrical enterprise. Nay, it might almost be said that this craze has proved a hindrance to electrical enterprise of every kind, although it is true that there are numerous local bodies in the country who are using electricity in one form or other. To put it bluntly, Parliament has conceded to local authorities a right to oppose the grant of powers to private bodies, with the result that although the opposing body may not be ready to embark upon enterprise on its own account, it is able to clog the wheels of private enterprise. Let us give an illustration of the way in which this right to oppose may be exercised. The electric lighting acts decree that if a private company seeks power to supply electricity in any district, it cannot obtain a provisional order for the purpose *except with the consent of the local authority*. It is true that a government department—namely, the Board of Trade—has power to dispense with this consent; but this power of dispensation has seldom, if ever, been exercised, and in the promotion of larger schemes for the spread of electrical power the opposition of local authorities is always the most formidable difficulty in the way of the promoters. We venture to quote, in illustration of this point, a passage from the history of a scheme known as the Administrative County of London Electric Power scheme, which was frustrated.

Strange as it may appear, the English metropolis is very badly served with electricity. Owing to the fact that many of the generating stations which do exist are small, out-of-date, and in such positions that fuel supply is a constant and increasing source of difficulty, the prices at present charged for electric light are far too high, while even the charges for electricity for power purposes are well nigh so large as to prohibit the use of electricity for power purposes. So expensive is the supply of electricity for lighting purposes that in many districts the street authorities are having recourse to gas instead of electricity for street lamps. It should be pointed out that the present supply, such as it is, is partly in the hands of private companies and partly in the hands of the borough councils. London is divided up into a number of boroughs and the council of many a borough has power to grant the right for supplying electricity for lighting.

Until 1904 no serious attempt was made to remedy this state of things in the English metropolis. In this year, however, a bill was brought before Parliament by which it was sought to establish a power scheme for the supply of the whole of London. Put shortly, the idea was to establish two or three large generating stations on the banks of the Thames. In such a position water-borne fuel can be easily obtained, while there is an ample supply of water for condensing purposes. It was proposed to use turbo-generators of large size. In order to have due regard for the vested interests of existing supply companies and borough councils, it was suggested by the bill to supply those bodies with power "in bulk" and allow them to redistribute it to the private consumer; and it was estimated that owing to the low cost of production the central body would be able to supply power in bulk at the extremely low price of 16 cents per kw-hour and yet make a profit. Seeing that this bill would be of enormous advantages to manufacturers it was received with acclamation by all who wanted a supply of electricity on a large scale for power purposes; and it may be prophesied that, had it not been for the opposition which was experienced from local authorities, the promoters would have been successful in their venture. What was the nature of this opposition? It came, in the first place, from many of the borough councils, who feared that the ultimate effect of the bill would be to oust them from their respective positions as electric supply authorities; and in the second place opposition came from the London County Council, which body, although they had no similar scheme of their own on the *tapis*, appeared to consider that the door should be kept open for them in the future. The bill was considered and ultimately approved by a committee of the House of Lords and a committee of the House of Commons, but owing to the bitter nature of the opposition the session of Parliament for 1904 was rapidly drawing to a close when the bill had passed through committee. Owing to pressure of other business the House of Commons was unable to consider the bill before August 12, with the result that it had to be dropped. If the promoters desire to repeat their attempt they must needs go over the same ground in the next session of Parliament. When it is mentioned that the cost of promotion in 1904 came to something like $250,000, the true meaning of opposition on the part of local authorities is brought into relief. Such is English parliamentary procedure that all this expense will have to be incurred in another session if the promoters are desirous of carrying out their undertaking. But as a matter of fact, what has happened in the meantime? The London County Council, who led the van of those who opposed the promoters, are now proposing to put forward a bill on their own account under which they will seek to supply power to the whole of London. This bill is to come up for consideration in 1906, and it is quite possible that Parliament, as then constituted, will lend a more favorable ear to the County Council than to those who were the founders and originators of the whole scheme.

What has been done on a large scale in the above case is continually occurring on a small scale in relation to the supply of electricity whether for lighting or power purposes. The development of electric tramway systems has been subjected to the same hindrances. Let us now draw attention to some of the advantages which a local authority supplying electricity enjoys, advantages which are by no means extended to private electrical undertakings. We have seen that a local authority may veto the grant of power to supply electricity to any company in its district; it may exercise this power whether it is or is not in a position to supply electricity itself. By so doing it may keep down opposition and preserve a virtual monopoly for itself.

Then again, suppose a private person or firm starts to supply his neighbors with electric light. The local authority, which in England as a general rule has control over the highways, may draw a circle around his area of supply by prohibiting him laying mains under or over the road. Further, in granting a supply on their own account, a local authority enjoys an immunity and a license which is not extended to ordinary companies. Thus an action brought against a supply company for negligence must be commenced within a certain time or it may not be commenced at all; and if the plaintiff loses his case he has to pay the defendant's costs on a scale which is much higher than that usually applicable. It may, however, be stated here, for the benefit of American readers, that in England, as a general rule, the unsuccessful party has to pay the successful party's costs. In ordinary cases they are a sufficient burden for the disappointed litigant; but when a local authority has been successful a very serious burden is imposed upon the unsuccessful party.

Having enumerated the disabilities under which private companies supply electricity in England, it may be asked why is no redress sought? The answer is that it has been sought without avail. Time and again bills have been introduced into Parliament for the purpose of removing that embargo which under existing conditions local authorities are enabled to put upon electrical enterprise. For some reason or other this bill has never been successful. It is hoped, however, that in some future session the question may have the earnest attention of the legislature.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Dec. 9th, 1905.

What is a "Fair" Price?—A Gas Engineer's Paradise.—A New Process for Estimating Naphthaline in Gas.

The question that appears at the commencement of the above list of items, is suggested by the attention that has been given to the selling price of gas by the Manchester District Association and others, and I suppose that almost every manager of gas works would reply by referring to the practice at his particular works. Some few might be candid enough to acknowledge that they were *not* selling at a fair price. But when the question is pressed home we must acknowledge that there is quite as much of expediency, that will insure sufficient sales, in the fixing of the terms of supply, as there is of a noble determination to be just and fear not, apart from the vulgar question of £ s. d. It is all very well to pose as champions of virtue and of uniform prices, but we must recognize that the convenience of our price is not without influence as determining its popularity. If we had a free choice we should all favor a uniform price, and that not cut too low. Such was the happy state of things in the gas industry for years, and I well remember a chairman of the old school, who used to pronounce with true John Bull determination, that, as long as he held the reins, he would see that the poor man had his few pennyworth of gas at the same rate per 1,000

cubic feet as the largest consumer. He has vacated his position in the ordinary course of nature, and if otherwise, I fear that by this time he would either have been compelled to modity his views, or to make way for a later cult. Various reasons may be brought forward for breaking in upon the uniform rule by the introduction of rebates or discounts according to the quantity used, or the circumstances under which it is used, but they can all be traced down to one disturbing element, and that is competition. A customer, either existing or prospective, is turning his attention to some other plan of lighting or heating, and the question is, what inducement can be offered to bring him round to the true faith.

The oft repeated assertion that the uniform rate is the only really honest method of selling is based upon a fallacy. Obviously every consumer should repay his cost to the company plus a fixed proportion of profit. And if the uniform rate is the right thing it follows that the cost per consumer per 1,000 cubic feet is also uniform, whereas it is a jumble of fixed charges, conditions of usage and many other things. Only a moderate proportion is represented by the actual expenditure per 1,000 cubic feet, not much more than the bare coal and wages at the works. The distribution costs are as much affected by the number of consumers as by the quantity sold, and there are legal charges, establishment expenses and other things that are absolutely independent of either. Of two consumers using a similar quantity per annum, one may only light up for 3 months in the year and use nothing during the other 9, while the other runs a small engine regularly for 10 hours a day on 300 working days. The capital outlay required in each case is very different. In regard to some of the items, it is like gtting a round post into a square hole, and they cannot be reduced to terms of per 1,000 cubic feet sold. So it is quite possible that a skilfully arranged table of differential prices comes nearer to actual justice than a uniform rate, or that a substantial departure may be taken from the one price system, not only without injury but with actual benefit to all concerned. Suppose a concern to be selling 50 million per annum at a fixed rate. Then the selling of an additional 20 millions at a lower rate does not necessarily mean that the users of the original 50 millions will have to pay more. It may be that they will be supplied for less, as obviously the increased output of 40 per cent. does not mean a proportionate increase in regard to established expenses, to clerical work and several other items.

While admitting all this, there is something in preserving a character for uniformity. Whatever may be the result of a technical valuation, the one price appeals to the man in the street, and the small consumer is the backbone of the concern. I pity the company that is dependent upon a limited number of large consumers, who are here to-day and gone to-morrow, from a gas consumer's point of view. With the continued progress of science and invention the large consumer becomes a more and more uncertain quality. Every week he is exploited by the drummers of some new system or other. The small user is a much more stable quantity. Give him a good service at a moderate price and he is not nearly so likely to change. This point should not be overlooked when the question of offering special considerations to a large customer is under consideration. The same concession given in the form of an all-round reduction may really do the concern more good even if it fails to capture the particular covey in question. When once the policy of special prices is admitted, where is the thing going to stop? Electricians have already to some extent pauperized and demoralized the public by providing everything free and by schedules of prices ranging from 1d. up to 7d. per unit, so there is the more need for a firm and robust attitude and for a recognition of the fact that it is possible to pay too much for the whistle. As a wholesome corrective to tendencies of this kind the sound, commonsense utterances of Mr. Thomas Newbigging may be specially recommended. Perhaps the suggestion made by that gentleman, that special concessions if made at all should be covered by a reduction in profits would be the best preventative of excessive discounts if adopted in practice. It certainly would bring many into the ranks of the one price party if persisted in to any extent, And there is some reason in the claim that, if the future stability and well being of the concern necessitates some concession, the same should be at the cost of the stockholder rather than the consumer.

The discussion of the question is complicated by the use of such terms as "fair price," "excessive discount" and other expressions that carry different meanings to different minds. No doubt a case can be made on behalf of a prompt payer, a large quantity or a long-hour user, but it should in all cases be based upon financial facts, with as little of opinion or guesswork as is practicable.

Some time ago I alluded to a gas engineer's paradise, and it now appears that the town of Leicester can lay a good claim to the title, according to Mr. Alfred Colson, the manager, who is in the best position to know. There is not a trace of naphthaline to be found in any main or service, and not a whisper of bad gas from any consumer. Every public lamp is doing its full duty. The whole of the apparatus at the works is free from naphthaline and there is no anxiety about excessive heats in the retorts, although the make per ton gives promise of reduced coal bills and wages sheets. The good fairy that has evolved such an enviable condition of affairs from a very different state is none other than Mr. Colson's process for washing the gas with a specially selected tar distillate, specific gravity 0.985, the price of which is put at only 4d. per gallon. At the present selling values of tar, gas engineers might do worse than turn their attention to the production of a 0.985 distillate from their own tar, in sufficient quantity to enable them to stand in for a share of the delectable state of affairs that is at present confined to Leicester. We have lately experienced a few weeks of cold weather and the general conditions of things in many works has been such as to lead to a trial of the Colson or of any other process. According to recent American investigations which have excited considerable interest over here it would appear possible that the naphthaline difficulties are accelerated even if not originated in the scrubbers and washers, just the point where Mr. Colson applies his soothing mixture, so he has indeed converted an enemy into a friend. Some years ago I remember hearing the remark that when naphthaline troubles appeared or increased it was time to clean out the scrubber and washer, and now it seems that as with many other things there was more in the advice than meets the eye.

Not the least difficulty in connection with the naphthaline nuisance is the tedious and complicated nature of the processes available for making a really reliable quantitative test. In a small or medium sized works where the manager has to conduct all the laboratory operations himself, experiments must be necessarily short and sharp and preferably of a simple character so as not to make too heavy a draught on the operator's technical skill. In works large enough to employ professional chemists this may not be of so much importance, but for every undertaking that is in a position to do so, there are a score that cannot. And, therefore, considerable interest attaches to a paper read at the Society of Chemical Industry a few days ago, describing a new method for estimating naphthaline in coal gas. The author is Mr. C. J. Dickenson Gair, of the Vauxhall works of the South Metropolitan Gas Company, and the improvement he has introduced consists of the use of acetic acid as the absorbing material. In the Colman and Smith process, which has hitherto been considered the best, a known quantity of gas is passed through a standard solution of picric acid and the solution is titrated for excess of free acid in the usual way. But there is this peculiarity that although the picric acid removes all the naphthaline, a portion separates out in the free state, and before the test can be completed, it must be combined and dissolved. The solution must be kept at a high temperature for 24 hours or more to secure this result. But Mr. Gair uses acetic acid as a sort of go-between. Having absorbed the naphthaline by its means, he adds picric acid to the solution, and at once obtains a precipitate of naphthaline picrate that can be separated out by filtration, dried and weighed. This plan is certainly far more suited to the requirements of the average gas manager than any other yet proposed, and should therefore facilitate investigation, as regards the actual quantity of naphthaline present in gas under different circumstances of manufacture and at various seasons of the year.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES

THE opening of the new office and salesroom of the La Porte (Ind.) Gas Light Company, which were formally "opened" the afternoon and evening of the 19th inst., was a notable occasion in the business happenings of that bustling Indiana city. Formal invitations were issued, music and refreshments were provided, and every lady visitor took away with her an appropriate souvenir. The offices are very suitably located in the premises 715 Michigan avenue, which is right in the business heart of La Porte.

THE Portsmouth (Va.) Gas Company has sold to the Norfolk, Portsmouth and Newport News Company the electrical equipment of the first named Company.

MR. JOHN WILLIAM FLETCHER, General Superintendent of the Fulton County (N. Y.) Gas and Electric Company, died at the Littauer Hospital, Gloversville, N. Y., after an operation for appendicitis, the morning of December 12th. He was born at Wilton, N. H., 34 years

ago, and was the son of the Rev. Stephen B. Fletcher. He was a student at Lehigh University, being graduated in the Class of 1900. On Feb. 14, 1901, he was married to Fanny Webb at Skowhegan, Me. They took up their residence at Fairfield, Me., but in September of the same year removed to Gloversville, at which time Mr. Fletcher entered the employ of the Fulton County Gas and Electric Company as Assistant Superintendent. Later he was advanced to the position of General Superintendent. He leaves his wife and one sister, Mrs. C. E. Dickerson, of Mount Hermon, Mass.

A CORRESPONDENT in Jackson, Mich., writing under date of the 15th inst, incloses the following: "At the December meeting of the Jackson Gas Company held some days ago the changes in the official staff of the Company were formally announced. Mr. Emerson McMillin, former Second Vice-President, resigned, and Mr. S. E. Wolff, former Manager in this city, but now General Manager of the gas, electric light and street railway properties at Saginaw, was elected to that office. Mr. Wesley Sears was chosen a member of the Board of Directors, and Mr. Homer M. Eaton of this city was officially made Secretary and General Manager of the Jackson plant. Mr. Wolff has already assumed the duties of his new position at Saginaw. The position of Manager of the Company's extensive properties is a responsible one, and the many friends whom Mr. Wolff has made during his stay in this city will rejoice at his deserved promotion. Mr. Eaton, his successor at the head of the Jackson Company, although a young man, has had an experience in the gas business which thoroughly qualifies him for his position."

MR. JOHN L. ANDERSON, of Beatrice, Neb., has been appointed Receiver in connection with the readjustment of the offices of the City Gas Company, of Beatrice. The moving spirit in the matter was the Farmers Loan and Trust Company, of New York.

MR. P. N. GUTHRIE has resigned the Superintendency of the Chemung County Gas Company, of Elmira, N. Y. We understand he has been appointed to a responsible position with the Pittsburgh (Pa.) Company.

AT the annual meeting of the Gas Light Company, of New Brunswick, N. J., the officers elected were: Directors, J. Bayard Kirkpatrick, J. C. Eisele, Nathaniel King, H. M. Barrett and Willard P. Voorhees; President, J. B. Kirkpatrick; Secretary, H. M. Barrett; Treasurer, J, C. Eisele.

"AT the annual meeting of the shareholders in the Waynesboro (Pa.) Gas Company the Directors elected were: Wm. H. Brown, E. Elden, Wm. Middlekauff, J. W. Clugston, Morris T. Brown. C. W. Schaibley and S. E. Buller. The last named gentleman succeeds Dr. L. Enniss. The Company declared an annual dividend of 5 per cent. on its capital stock, out of the earnings of the past year, payable January 15th. The annual statement made to the stockholders was highly satisfactory and showed the best year in the history of the Company. Notwithstanding a 10 per cent. reduction in the price of gas, its revenues increased each month over the corresponding months of last year. During the past 5 years the introduction of gas stoves has become more general and 500 are now in use in Waynesboro. The Company is one of the most progressive of the corporations in town, and during the last two years has greatly extended its mains and made many new connections. Next year holds the promise of being even a more profitable one than the past.—T. J. R."

THE State Commission of Gas and Electricity has denied the application of the proprietors of the Clyde (N. Y.) Gas and Electric Company for the right to incorporate and to issue capital not to exceed $25,000. This really would only have been a revamping of an old Company. The application was opposed by the Wayne County Electric Company, which operates a plant in the village of Lyons and furnishes electricity to the village of Clyde.

THE State Commission of Gas and Electricity has granted the application of the proprietors of the Palmyra (N. Y.) Gas and Electric Company for the right to issue bonds in the sum of $40,000.

THE Ludington (Mich.) plant is now in active operation. Work on the plant was not commenced until July 17th last.

THE following letter fully explains itself: "Benjamin W. Wall, Fire Commissioner, City of Boston—Dear Sir: I have pleasure in inclosing herewith check for $500, being donation to the Boston Firemen's Relief Association. Will you kindly turn this over to the proper officials and at the same time convey to your men our thanks and appreciation for the good work performed by them at the fire in our North End works on Saturday night last. Yours very truly, J. L. RICHARDS,
"President Boston Consolidated Gas Company."

THE proprietors of the Wooster (O.) Cas Light Company have put out a new schedule of rates. The main feature of the tables that go into effect January 1st is a concession of 20 per cent. from the ruling rates.

AT a special meeting of the St. Paul (Minn.) Gas Light Company the Directors chosen were: G. A. Perdicaris, Trenton, N. J., and Asa Goodrich, F. L. Goodrich, A. J. Goodrich and E. S. Goodrich, of St. Paul.

MR. WM. MERRITT will be retained as Superintendent of works by the new owners of the Lebanon (Pa) Gas Company.

AFTER the 1st prox. the permanent headquarters of the New York State Commission of Gas aud Electricity will be on the first floor of Geological Hall, State Building, Albany.

MR. LA FOREST BLYTER has resigned from the service of the Capital City Gas Light Company, of Des Moines, Ia., to become General Manager of the Gas Appliance Company, of St. Paul, Minn.

A CORRESPONDENT in Boise, Idaho, writing under date of the 19th inst., says: "The annual meeting of the proprietors of the Boise Gas Light Company was duly held according to announcement. The only important change in the officers was the election of Mr. Charles Theis, of Spokane, as Vice-President of the Company, in place of Mr. W. E. Pierce. The following were the Directors elected: A. Ross, W. N, Donaldson, C. D. Lamson, Boise; Charles Theis and W. A. P. Richards, Spokane. Upon adjournment of the stockholders' meeting the Directors met and elected the following officers: President, A. Ross, Boise; Vice-President, Charles Theis, Spokane; Secretary-Treasurer, W. N. Donaldson, Boise. The Company has made excellent progress in its business during the last year, according to the report of the Secretary-Treasurer. The business has even progressed beyond the expectation of the Company, which affords much satisfaction to the members. Extensive improvements are to be made by the Company in the near future. At the meeting $50,000 was appropriated for use in extending the mains to every part of the city proper not now covered. This sum will be sufficient, it is thought, to reach every section within the original city boundaries and probably extend into some of the additions. The matter of extending the system to South Boise was discussed and it is possible that that will be done next summer. It is the intention of the Company to spread out as much as is consistent. Its generating plant is sufficient to supply a city of 50,000 inhabitants. It was decided to increase the output of the tar paper plant, which utilizes the by-product of the gas plant, and place the paper on the Boise market. The paper made here is of a superior quality and its manufacture is quite an industry for the city."

AT the special election held in Independence, Kas., on the 14th inst., which election was held for the purpose of determining whether or not the natural gas ordinance recently granted to the General Light, Heat and Power Company should be indorsed, the result was in the negative —278 for; 434 against.

THE proprietors of the Peoples Gas and Electric Company, of Oswego, N. Y., have purchased the premises on East First street, known as the Doolittle Block. The building will be remodeled and used by the Company as office headquarters.

THE South Bend (Ind.) Gas and Fuel Company has been formally taken over by the Geist syndicate. Mr. B. W. Perkins will remain as Superintendent.

THE Red Wing (Minn.) Gas Light and Power Company has been incorporated by Messrs. O. M. Hall, P. C. Thompson, A. F. White, F. N. Crosby, R. L. Aldrich and Fred. A. Platt. It is capitalized in $100,000.

THE new holder for the Rochester (N. Y.) Railway and Light Company, which has been in operation since the 1st inst., is giving Superintendent Tippey much satisfaction. It is up to retaining 2,000,000 cubic feet. The Company's total storage capacity is 3,400,000 cubic feet.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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ELBERT P. CALLENDER,
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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, DECEMBER 25, 1905.

The Market for Gas Securities.

The closing for local gas securities was not very much out of the way this week as compared with last. Consolidated closed at 178¼ to 179 ex dividend, recovering quite a bit between the high and low points for the week. The sharp slump occasioned by the cut in the dividend rate for the next quarter on the shares of the Peoples Gas Light and Coke Company, of Chicago, was put up to Mr. A. N. Brady, but why that should be so the average buyer knows not, in so far as New York city is concerned. The Chicago Company is now on a 5 per cent. basis.

Brooklyn Union is well held at 175 to 185. The proprietors of the New Orleans Railways and Light Company have declared a dividend of 1½ per cent. on the preferred stock, which is the first dividend payment since the reorganization of the old New Orleans Railway Company last June. The National Fuel Gas Company has announced its intention of retiring $1,400,000 of its debentures, and will also double the ordinary return on its capital stock. Baltimore Consolidated is 85 to 86½, and it is cheap at those figures.

The West Shore Gas Company, of Haverstraw, N. Y., has been incorporated by Messrs. Timothy Murray, G. H. Franconer and Neil Kelley, of New York. It is capitalized in $85,000, and is likely only an attempt to galvanize certain Rockland county gas interests that were supposed to be beyond resurrection.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DECEMBER 25.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	178¾	179
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	275	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	111	114
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	105	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	112	114
" 1st Con. 5's	1,500,000	..	106⅛	108⅛
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	175	185
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	⅝	..
" ncome Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1.000	47½	50
Buffalo City Gas Co.	5,500,000	100	10	12
" " Bonds, 5's	5,350,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	104¾	105
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,683,750	100	..	95
Preferred	3,026,500	100	107⅛	108
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	85	86½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98⅛	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
For Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104⅛	105
Hartford	750,000	25	199	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	110	110¾
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104⅛	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	..
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108¼	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1 000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	100	100⅛
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104⅛	105¼
San Francisco, Cal.	15,800,000	100	58⅛	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112¼	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	296⅛	299⅝
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600.000	50	230	..

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
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PHILADELPHIA, PA., Dec. 13, 1905.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Jan. 15th, 1906, to stockholders of record at the close of business December 30, 1905. Checks will be mailed.

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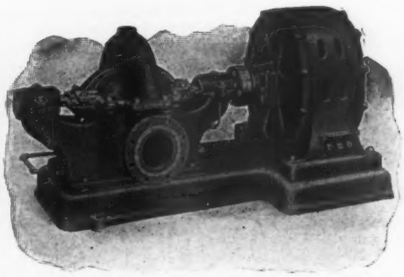

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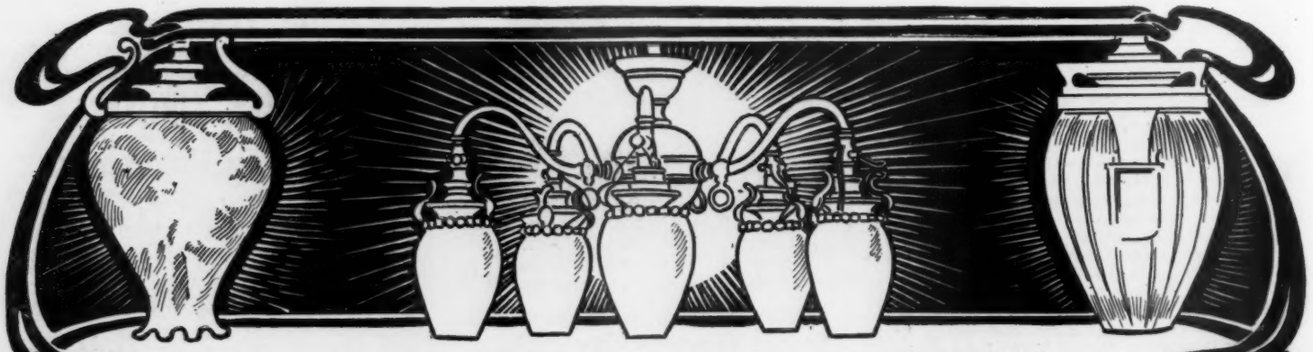

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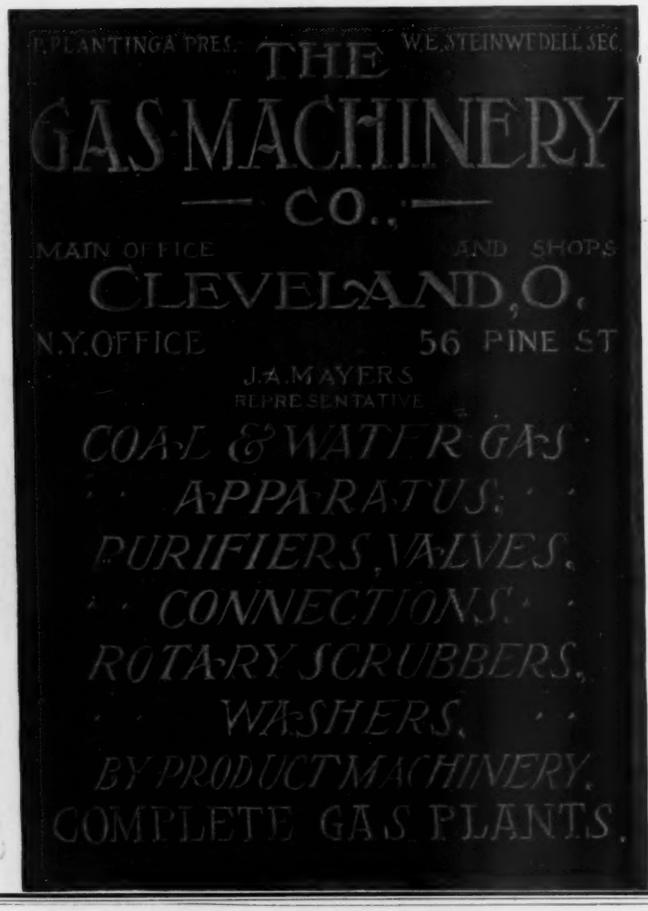

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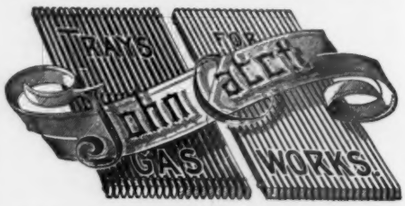

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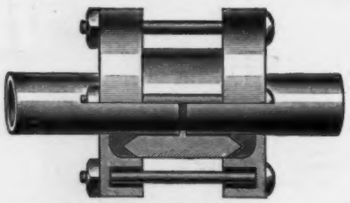
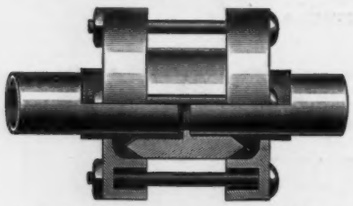
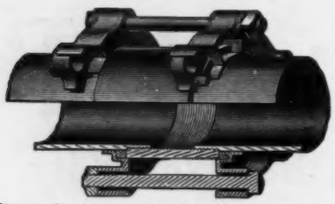


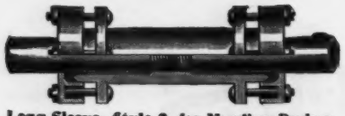
Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



Insulating Coupling, Style 5, for Plain End Wrought Iron Pipe,



Clamp, Style 4, for Repairing Leaks on Screw Collar.



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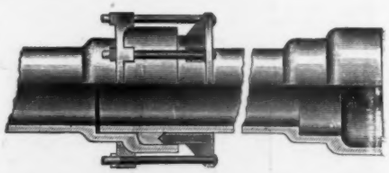

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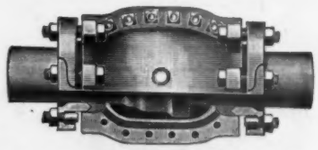

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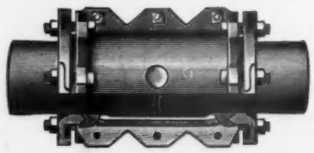

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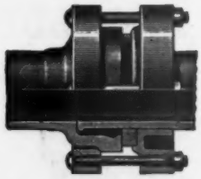

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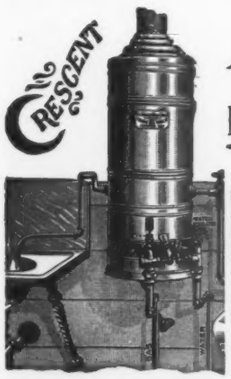

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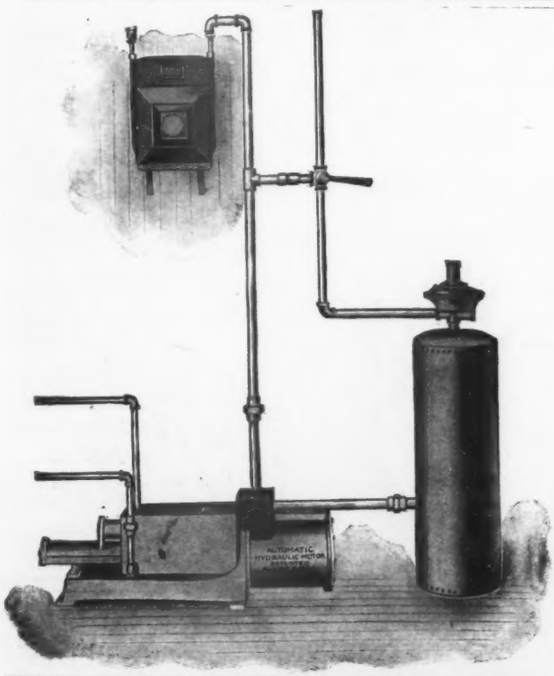

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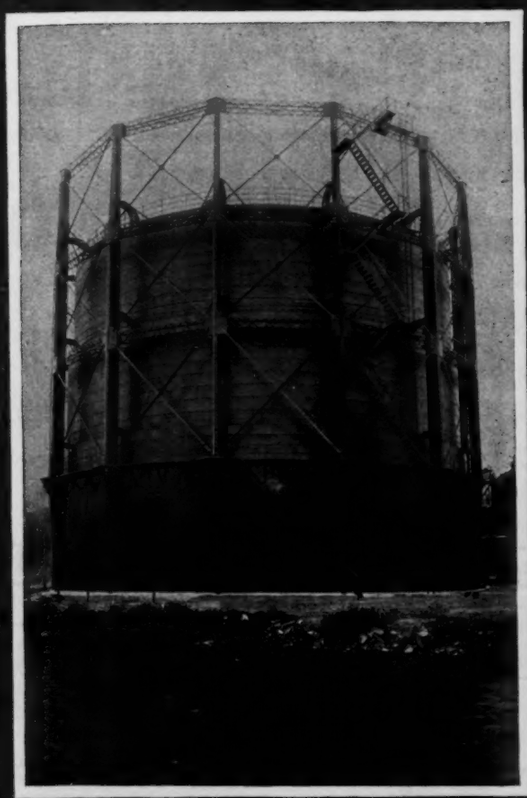

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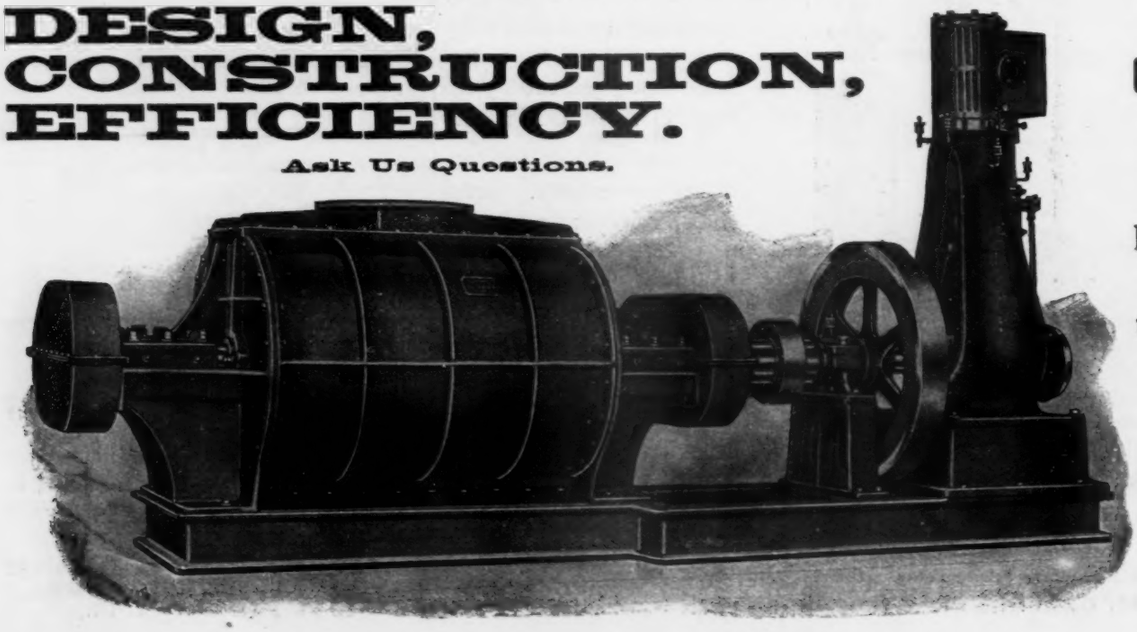

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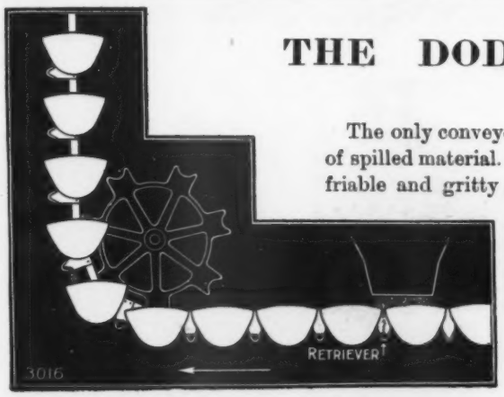

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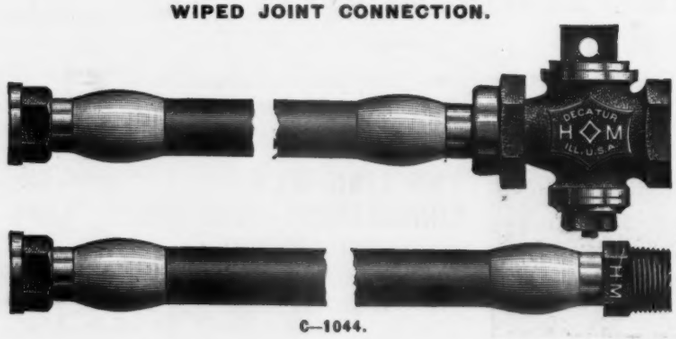

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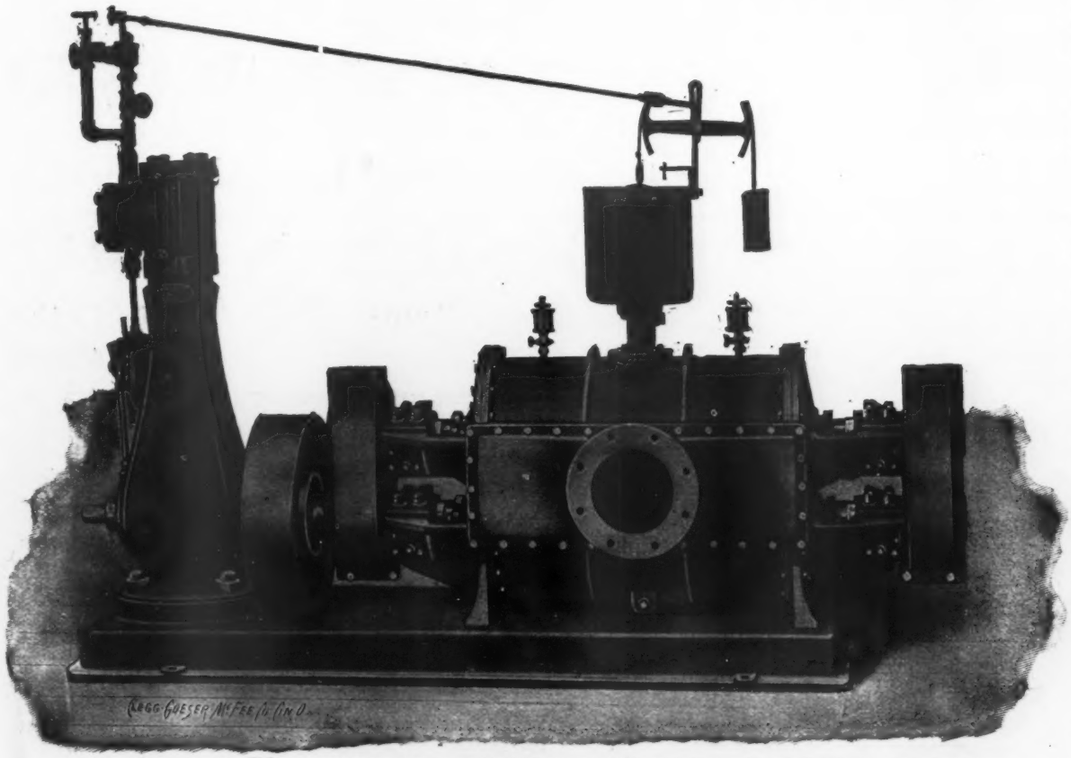

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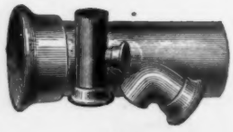
Established 1856. Works at Phillipsburgh, N. J.



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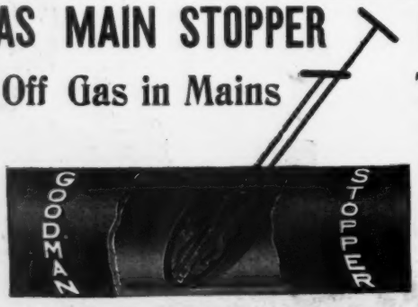
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :



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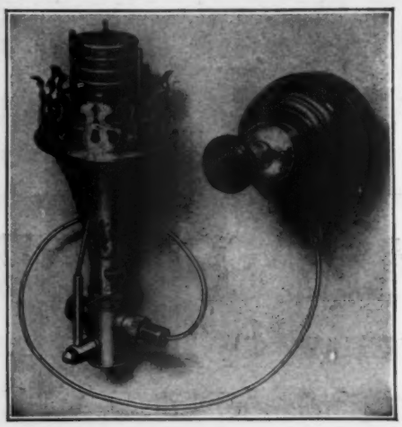

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PNEUMATIC GAS LIGHTER

BEATS

ELECTRICITY in CONVENIENCE,

MAKES

INCANDESCENT GAS LIGHTING

PERFECT.

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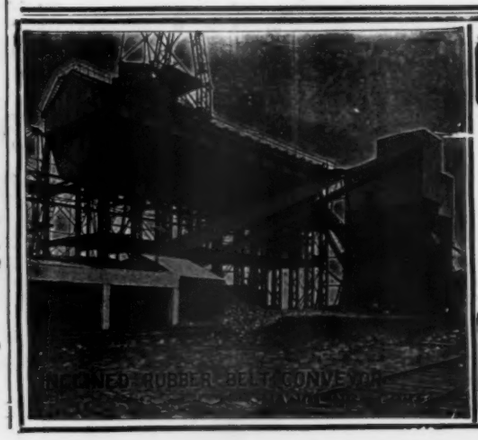
THE PURIFIED GAS REVIVES THE FOULED OXIDE.



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BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

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The Link-Belt Machinery Co.
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AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

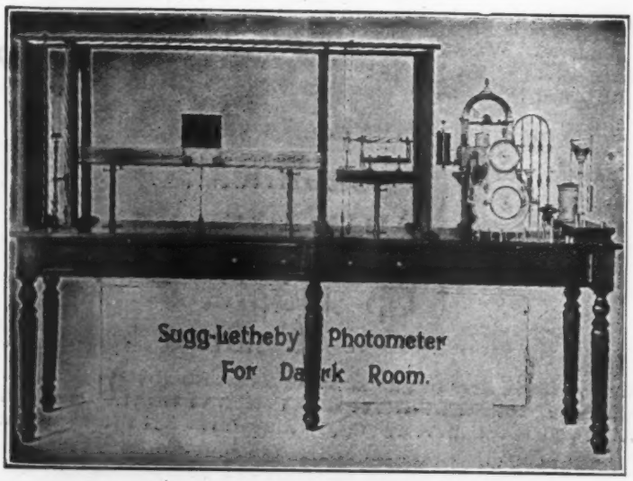
JANUARY, 1906.

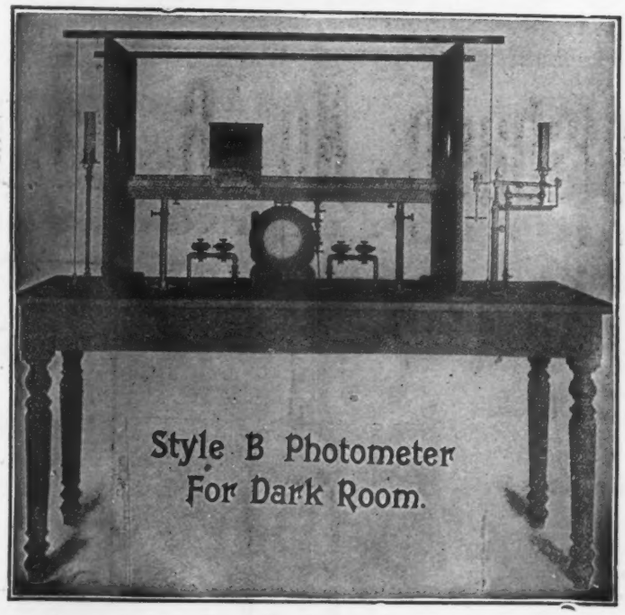
Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Mon.	1	10.40 PM	6.20 AM
Tue.	2	11.40 FQ	6.20
Wed.	3	12.40 AM	6.20
Thu.	4	1 30	6.20
Fri.	5	2.30	6.20
Sat	6	3.20	6.20
Sun.	7	4.20	6.20
Mon.	8	5.10	6.20
Tue.	9	No L.	No L.
Wed.	10	No L. FM	No L.
Thu.	11	No L.	No L.
Fri.	12	5.20 PM	8.10 PM
Sat.	13	5.20	9.10
Sun	14	5.20	10.20
Mon.	15	5.30	11.30
Tue.	16	5.30	12.40 AM
Wed.	17	5.30 LQ	1.40
Thu.	18	5.30	2.50
Fri.	19	5.30	4.00
Sat.	20	5.30	5.10
Sun.	21	5.40	6.20
Mon.	22	5.40	6.20
Tue.	23	5.40	6.20
Wed.	24	5.40 NM	6.20
Thu.	25	5.40	6.20
Fri.	26	5.40	6.20
Sat.	27	5.40	6.20
Sun.	28	5.40	6.10
Mon.	29	9.30	6.10
Tue.	30	10.20	6.10
Wed.	31	11.20	6.10

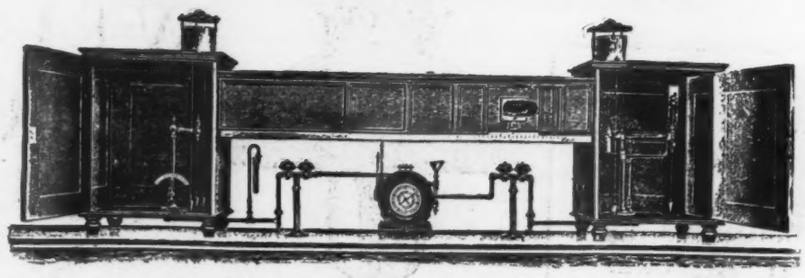
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

JANUARY, 1906.

Day of Week.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Date.	Light	Extinguish.
		P. M.	A.M.
Mon.	1	4.30	6.30
Tue.	2	4.30	6.30
Wed.	3	4.30	6.30
Thu.	4	4.30	6.30
Fri.	5	4.30	6.30
Sat.	6	4.30	6.30
Sun.	7	4.30	6.30
Mon.	8	4.40	6.30
Tue.	9	4.40	6.30
Wed.	10	4.40	6.30
Thu.	11	4.40	6.30
Fri.	12	4.40	6.30
Sat.	13	4.40	6.30
Sun.	14	4.40	6.30
Mon.	15	4.50	6.25
Tue.	16	4.50	6.25
Wed.	17	4.50	6.25
Thu.	18	4.50	6.25
Fri.	19	4.50	6.25
Sat.	20	4.50	6.25
Sun.	21	4.50	6.25
Mon.	22	5.00	6.25
Tue.	23	5.00	6.25
Wed.	24	5.00	6.25
Thu.	25	5.00	6.25
Fri.	26	5.00	6.25
Sat.	27	5.00	6.25
Sun.	28	5.00	6.25
Mon.	29	5.05	6.15
Tue.	30	5.05	6.15
Wed.	31	5.05	6.15

TOTAL HOURS DURING 1906.

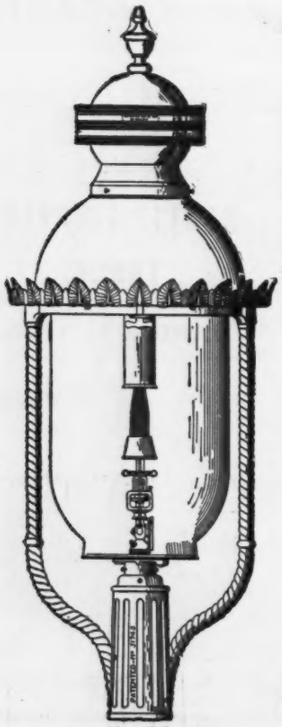
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

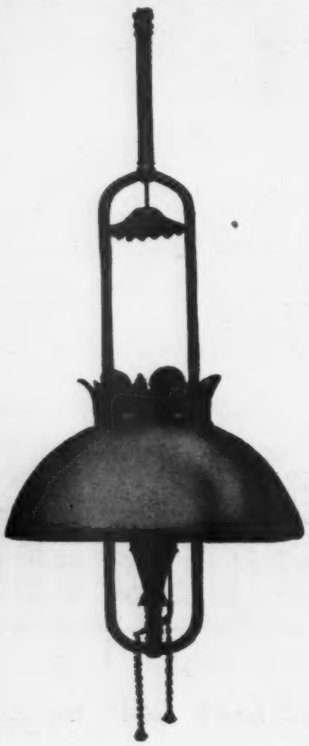
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

WELSBACH CO.,

Salesrooms in all the principal cities of the United States.

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THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 1st, 1905, has been Awarded Contracts for 32 Sets of

Standard Double-Superheater Lowe Water Gas Apparatus.

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Detroit, Mich. (2d contract).	**New Britain, Conn.**	**Hamilton, O.** (2d contract).
Springfield, Ills.	**Ludington, Mich.**	**Indianapolis, Ind.** (2d contract).
Oneonta, N. Y. (2d contract).	**New York,** Mutual Co. (2d contract).	**Hazleton, Pa.**
Pottsville, Pa. (2d contract).	**St. Louis, Mo.** (4th contract).	**Mahanoy City, Pa.**
Evansville, Ind. (2d contract).	**Sioux City, Ia.** (3d contract).	**Nanticoke, Pa.**

TOTAL SETS TO JULY 1ST, 1905, ... 585
TOTAL DAILY CAPACITY TO JULY 1ST, 1905, . 455,980,000 CU. FT.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

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SPECIAL HIGH GRADE REFRACTORY MATERIAL FOR BENCH SETTINGS AND WATER GAS LININGS.

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CORRESPONDENCE SOLICITED.

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An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by
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Modern Coal Gas Benches,

With either Horizontal or Inclined Retorts, Half-Depth and Full-Depth Recuperative Furnaces.

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STANDARD BENCH IRONWORK.

Linings for Water Gas Apparatus, High Grade Fire Brick of All Shapes and Sizes, Ground Fire Clay, Ground Fire Brick in Bulk or in Barrels.

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A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

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These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

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COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

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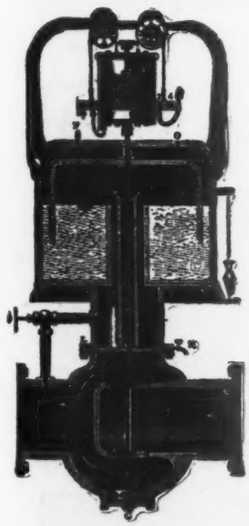

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Automatic, Balance, High Pressure and Service Governors,

Roots Improved Gas Exhausters,

Iron Sponge, Purifying Material for Gas Purification Jones Jet Photometers Pressure Registers, etc.,

INSTALLATION OF SMOKELESS TAR BURNING SYSTEM,

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For the Year 1904.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 36th Year of Publication.

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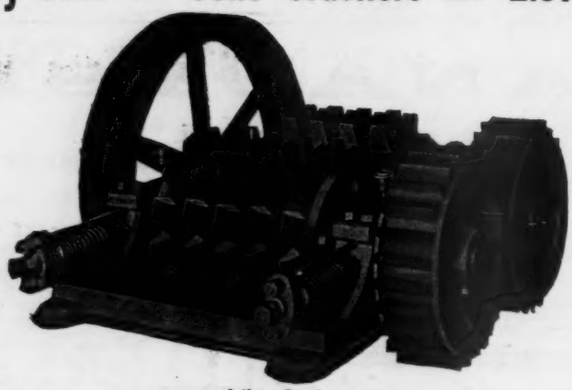

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KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

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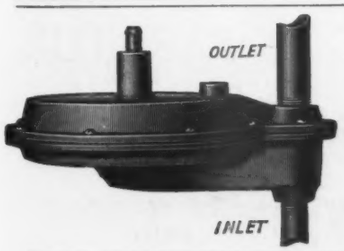

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Our Governors Reduce 30 or 40 Pounds Pressure to 2 Inches Water Pressure.

WE MAKE ALL SIZES OF

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Write for Catalogue and State what you Need.

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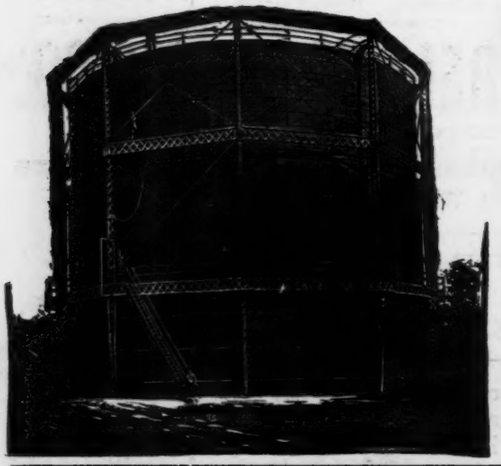

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$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

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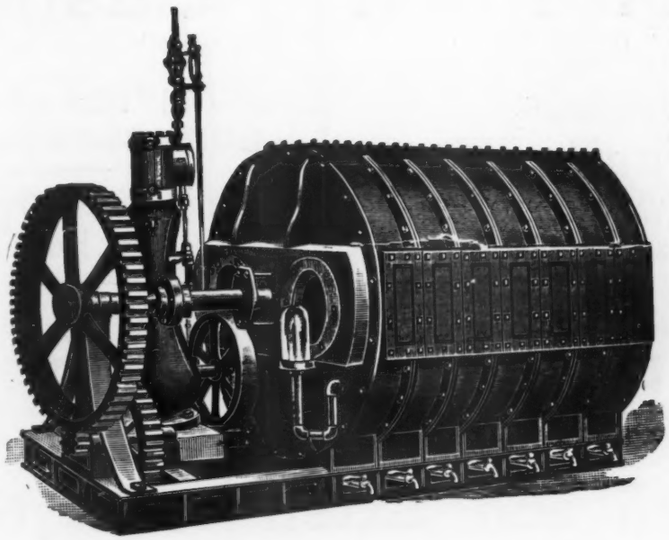

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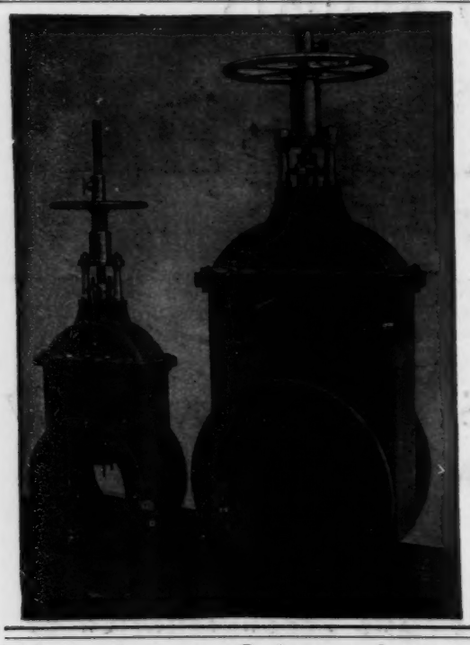

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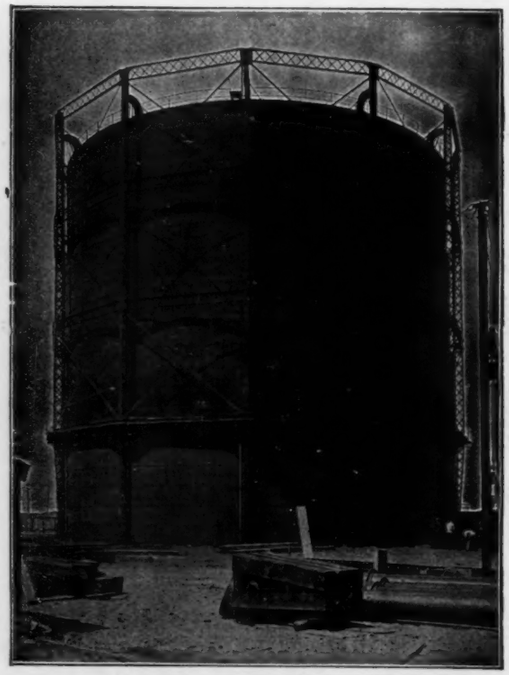

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